A STUDY OF THE DISTRIBUTION AND TAXONOMY OF THE PERCID FISH *PERCINA NIGROFASCIATA* (AGASSIZ) [1]

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The writer became interested in species of *Percina* during a collecting trip throughout the southeastern United States in the spring of 1951. On this trip he was constantly impressed with the apparent adaptiveness to many different habitats of one of the species of *Percina* in particular, *Percina nigrofasciata* (Agassiz). We consistently collected this species from the black waters of the coastal plain, the rivers, streams and tributaries of the piedmont region, and the headwaters in the mountains. Not only did *P. nigrofasciata* occur in all of the aforementioned habitats, but seemed to vary in appearance from place to place.

Objectives

The objectives of this study were as follows: 1. What is the range and pattern of *P. nigrofasciata?* 2. Does this species vary throughout its range, or is it a stable form? 3. If variation is exhibited, by what characters are the differences expressed? 4. Where was the origin of this species, and by what routes did it disperse? 5. What are its relationships to other species of *Percina* throughout its range?

The study has uncovered a new subspecies here named *Percina nigrofasciata raneyi,* several intergrading populations, *P. n. nigrofasciata* X *P. n. raneyi,* and even further evidence of incipient speciation in the definition of eight well-defined races.

Ideas, based on the best evidence available at present, concerning the origin and dispersal of *P. nigrofasciata* are here expressed. Comparisons with other species of *Percina* are also included. Discussion of the above topics appears in the appropriately designated sections of the paper.

Methods

Several scale and fin counts were made. Specimens over forty millimeters in standard length were utilized in the majority of cases. However, in some drainages it was necessary to count specimens in the twenty to thirty millimeter range as larger individuals were not available.

Two counts were discarded during the course of the study. These were the number of scales on the mid-line of the belly of males and the number of anal rays. The former count is inconsistent due to the large number of adventitious scales present in many individuals. Whether belly scales were normal or adventitious was also difficult to determine. The anal ray count was eliminated after nearly five

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hundred specimens had been counted with no appearance of consistent variation in specimens from any drainage. As a routine random samples from each additional drainage encountered were counted, and still no variation was observed. The number of anal rays (usually 9) in specimens of *P. nigrofasciata* appears to be a very stable character.

The scales and fin rays were counted according to Hubbs and Lagler (1947: 8-12).

In so far as possible, proportional measurements were taken on fishes between fifty-five and sixty-five millimeters in standard length. In some drainages, however, it was necessary to resort to larger and smaller individuals. In no instance was a specimen measured below forty-five millimeters in standard length. Representative samples from each drainage throughout the range were measured. This sample usually consisted of ten specimens from each drainage. In a few drainages from which the collections were small, less than ten specimens were measured. In the Apalachicola Bay drainage a large sample was available, and twenty specimens were measured. In the St. Johns drainage fifteen specimens were measured in order to have adequate data for comparison with *P. nigrofasciata westfalli,* which was described from this drainage on the basis of one specimen. Fifty males and fifty females were measured throughout the range of *P. nigrofasciata* to detect any apparent proportional sexual dimorphism (Table 10). No appreciable differences were present, so males and females are tabulated together in the tables of proportional measurements. For specimens of *P. n. raneyi,* ten males and ten females were compared (Table 10). Again, no appreciable differences were noted. Both sexes of this subspecies are also tabulated together.

Measurements were made with dial calipers which measured accurately to one tenth of a millimeter.

Proportions are expressed in millimeters, largely following the format of Hubbs and Raney (1939: 5-6).

Proportional measurements were for the most part, taken as described by Hubbs and Lagler (1947: 13-15).

Other proportional measurements were taken as described below:

Length of longest caudal ray; from the middle of the base of the hypural plate to the tip of the longest ray.

Distance; from the insertion of the most anterior pelvic fin ray to the union of the gill membranes.

Distance; from the tip of the mandible to the union of the gill membranes.

Distance; from the most anterior tip of the pelvic girdle to the union of the gill membranes.

Collections by drainage systems were summarized, tabulated and also presented in the form of graphs (figs. 1-8) according to Dice and Lerass (1936: 1-3) as modified by Hubbs and Perlmutter (1942: 582-92) and Hubbs and Hubbs (1953: 49-56, 92). The lone specimen from a direct tributary of the Mississippi River was not included in the plot of histograms in the graphs.

Material Examined

The following is an explanation of the symbols used in describing the material examined. The number of specimens and the range of standard length in millimeters are indicated in parentheses. In addition to standard compass directions, with the following "of" deleted, these abbreviations are used: Co. = County, R. = River, Cr. = Creek, trib. = tributary (of), Rtes. = routes, mi. = mile, Rd. = road, junct. = junction, Hwy. = highway, CU = Cornell University, UMMZ = University of Michigan, Museum of Zoology, USNM = United States National Museum, TU = Tulane University, FSU = Florida State University, FU = University of Florida, and KS = Kirk Strawn (private collection).

Mississippi River Drainage

Louisiana.—*West Feliciana Par.:* CU 16300 (1, 35), Alexander Cr., trib. Thompson Cr., 1.1 mi. E. junct. Rtes. 65 and 61.

Lake Pontchartrain Drainage

Louisiana.—*Tangipahoa Par.:* CU 21547 (1, 29) Natalbany Cr., 0.8 mi. W. Baptist; TU 2998 (1, 41), Tangipahoa R., 1 mi. E. Pontchatoula; TU 3933 (11, 32-90) Natalbany R., 0.7 mi. W. Baptist; TU 3740 (4, 51-68), Beaver Cr., 3.9 mi. S. Kentwood; B 40-89 (38, 46-80), Tchefuncte R., 10.5 mi. SW. Franklinton; B 40-88 (4, 34-40), Tangipahoa R., 1.5 mi. E. Amite. *St. Helena Par.:* TU 1076 (4, 56-65), trib. Tickfaw R., 3.3 mi. SW. Greensburg. **Mississippi.**—*Wilkinson Co.:* UMMZ 146616 (19, 43-82), trib. Amite R., 2 mi. S. Centerville; UMMZ 144713 (1, 42), trib. West Amite R.

Pearl River Drainage

Mississippi.—*Marion Co.:* CU 18862 (25, 48-64) trib. Pearl R., 8 mi. from Angie, La.; CU 16606 (8, 44-69), trib. Pearl R., 2.7 mi. N. Sandy Hook; TU 53 (4, 31-48), trib. Pearl R., 4.6 mi. N. Sandy Hook; TU 66 (3, 41-64), trib. Pearl R., 0.6 mi. N. La. State line; TU 87 (2, 46-48), trib. Pearl R., 1.2 mi. N. La. State line; TU 3967 (25, 37-64), trib. Pearl R., 4.8 mi. SE. Columbia; TU 160 (22, 22-52), trib. Pearl R., 2.5 mi. S. Hub, 8.5 mi. S. Columbia; TU 1729 (11, 35-70), Sweetwater Cr., 4.3 mi. N. Sandy Hook; TU 1864 (2, 47-51), Pearl R., 2.3 mi. E. Sandy Hook; TU 113 (13, 39-83), trib. Pearl R., 2.7 mi. N. Sandy Hook; TU 22 (1, 38), trib. Pearl R., 4.8 mi. SE. Columbia; TU 3875 (2, 57-60), trib. Pearl R., 1.7 mi. S. Sandy Hook; TU 1793 (11, 40-77), Sweetwater Cr., 4.3 mi. N. Sandy Hook. *Pearl River Co.:* CU 16606 (2, 38-41), 2.7 mi. N. Sandy Hook; TU 1635 (5, 44-49), 4.6 mi. N. junct. Rtes. 43 and 26; TU 1552 (4, 36-66), 5.7 mi. W. Angie; TU 3374 (3, 59-68), Lots Cr., 6 mi. NW. Picayune; UMMZ 163703 (1, 62), trib. Wolf R., 3 mi. NE. Poplarville; UMMZ 166132 (4, 27-48), Hobolochitto Cr., 0.9 mi. N. Picayune. *Lincoln Co.:* UMMZ 161165 (8, 33-64), Little Bahala Cr., 3.5 mi. E. Brookhaven; UMMZ 161183 (1, 48), Big Cr., 0.5 mi. N. Bogue

Chitto; UMMZ 161191 (3, 57-62), stream, 2.5 mi. N. Bogue Chitto; CU 16267 (7, 35-49), trib. Pearl R., 8.8 mi. W. Monticello. *Walthall Co.:* UMMZ 155358 (1, 66), Bogue Chitto R., 7 mi. W. Tylertown; UMMZ 144441 (1, 43), Copiah Cr., trib. Pearl R.; UMMZ 155374 (7, 41-64), trib. McGee Cr., 4.3 mi. SSW. Tylertown. *Copiah Co.:* UMMZ 144445 (3, 18-20), Beaver Dam Cr., trib. Bahala Cr. *Pike Co.:* UMMZ 113782 (1, 41), trib. Bogue Chitto R., 3 mi. N. Summitt. **Louisiana.**—*Washington Par.:* CU 16328 (2, 38-41), Bogue Lusa, 9.6 mi. E. Franklinton; TU 1552 (4, 36-66), trib. Pearl R., 5.7 mi. W. Angie; TU 1176 (2, 32-52), Pushepatapa Cr., 8.2 mi. N. Bogalusa, 0.8 mi. S. Varnado; TU 1151 (20, 32-52), trib. Pearl R., 3 mi. N. Bogalusa; TU 3602 (6, 24-48), trib. Pearl R., 8.5 mi. W. Angie; TU 2894 (4, 35-53), Bogue Chitto, 0.7 mi. W. Warnerton; TU 3828 (26, 32-80), Pushepatapa Cr., 8.2 mi. N. Bogalusa; TU 3237 (2, 21-34), trib. Pearl R., 11.8 mi. W. Angie. *St. Tammany Par.:* TU 730 (25, 43-65), trib. Pearl R., 1 mi. N. Talisheek; UMMZ 166155 (16, 32-56), cr. on Rte. 58, 0.3 mi. N. Talisheek.

Pascagoula River Drainage

Mississippi.—*Lamar Co.:* CU 15638 (12, 38-73), trib. Black Cr., 6.9 mi. W. Forrest Co. line, 7.9 mi. W. Hattiesburg city limits; TU 1620 (3, 41-57), Red Cr., 0.3 mi. N. Lumberton Hwy.; UMMZ 163725 (21, 26-63), Black Cr., below US Hwy. 11 bridge, 10 mi. SW. Hattiesburg, 4 mi. NNE. Purvis. *Clarke Co.:* CU 11763 (25, 49-85), trib. Chunky Cr., 0.6 mi. N. Enterprise; UMMZ 157797 (1), Chickasawhay R., 1 mi. N. Enterprise; UMMZ 157795 (1, 42), Wier Cr., trib. Chickasawhay R. *Forrest Co.:* CU 15668 (12, 36-57), trib. Leaf R., 3.7 mi. N. Hattiesburg; CU 12647 (3, 47-52), Pascagoula R., 6.5 mi. NW. Forrest and Perry Co. line, Rte. 24; CU 12658 (11, 39-58), Pascagoula R., 6.5 mi. NW. Forrest and Perry Co. line, Rte. 21; TU 1560 (6, 38-59), Priests Cr., 0.6 mi. S. junct. Rte. 49 and business section Hattiesburg. *Covington Co.:* CU 12583 (1, 50), trib. Bowie Cr., 10.9 mi. W. Collins. *Wayne Co.:* CU 16251 (3, 48-63), trib. Chickasawhay Cr., 11.9 mi. NW. Bucatunna; CU 16238 (1, 68), trib. Chickasawhay Cr., 7.2 mi. NW. Bucatunna. *Jackson Co.:* TU 568 (3, 31-48), trib. Pascagoula R., 3.6 mi. N. Wade. *George Co.:* TU 1136 (1, 72), Rocky Cr., 3.4 mi. SE. Lucedale; UMMZ 155792 (3, 53-71), trib. Escatawpa R., 3.3 mi. E. Lucedale. *Jasper Co.:* UMMZ 157815 (4, 19-46), trib. Big Bogue Homo R., 3.5 mi. NNW. Sandersville. **Alabama.**—*Mobile Co.:* CU 12467 (6, 47-85), Escatawpa R., Big Cr., 5.3 mi. W. Semmes on Rte. 42; TU 59 (6, 40-67), trib. Escatawpa R., 6.8 mi. E. Hurley.

Mobile Bay Drainage

Alabama.—*Mobile Co.:* CU 12637 (3, 48-58), trib. Chickasaw Cr., 5.2 mi. E. Semmes; CU 16657 (14, 44-72), Clear Cr., 4.7 mi. E. Semmes; TU 2061 (3, 25-51), Sand Hill Cr., trib. Chickasaw Cr., 6.7 mi. S. Citronelle; TU 1640 (2, 40-49), Cedar Cr., trib. Tombig-

bee R., 8.7 mi. W. Mount Vernon; UMMZ 155466 (5, 42-53) Cr., trib. Chickasaw Cr., 5.5 mi. SE. Semmes; UMMZ 86300 (3, 50-75), near Mobile Ala. *Washington Co.:* CU 16167 (3, 40-61), Gaines Cr., trib. Bassett Cr., 2.8 mi. S. Leroy; TU 1816 (3, 35-52), Bilboa Cr., trib. Tombigbee R., 12.6 mi. S. Wagarville. *Baldwin Co.:* CU 16659 (1, 47), trib., 2.5 mi. E. junct. Rtes. 90 and 31, 10 mi. E. Mobile; CU 16669 (10, 33-55), trib. Fish R., 10.2 mi. W. Roberts Dam; TU 3680 (2, 34-46), trib. 9.2 mi. WNW. Loxley; TU 3090 (6, 34-60), trib. 0.3 mi. S. junct. Rtes. 90 and 89, 3.6 mi. N. Daphne; TU 1774 (2, 43-69), trib. Fish R., 2.1 mi. SE. crossroads at Malbis Restaurant, 5.1 mi. NW. Loxley; TU 3158 (2, 34-61), trib. Fish R., 6.1 mi. E. junct. Rtes. 104 and 89. *Butler Co.:* TU 3201 (1, 43), Pine Barren Cr., 2.5 mi. S. Forest Home. *Wilcox Co.:* TU 2572 (1, 53), Big Turkey Cr., trib. Pine Barren Cr., 0.8 mi. W. Allen; TU 3436 (10, 51-67), Pursley Cr., trib. Alabama R., 3.4 mi. SW. Camden; TU 3064 (1, 50), trib. Pursley Cr., 1.8 mi. E. Camden. *Clarke Co.:* TU 2617 (2, 51-52), Bassett Cr., trib. Tombigbee R., 0.5 mi. E. Wheatley. *Montgomery Co.:* API 601 (4, 46-70), Line Cr., S. Montgomery; UMMZ 128769 (5, 43-68), Line Cr. (Oakfuskee Cr.), near Montgomery-Mason Co. line. *Lee Co.:* API 589 (1, 45), Loblockee Cr., 8 mi. N. Auburn; UMMZ 160895 (1, 43), Saugahatchee Cr., 3.0 mi. NW. Loachapoka. *Macon Co.:* API 608 (2, 59-62), Sand Springs; API 585 (3, 41-55), 3 mi. E. Tuskegee; UMMZ 111239 (1, 61), 3 mi. E. Tuskegee on Columbus Rd.; UMMZ 123986 (1, 55), Big Swamp, 5 mi. SE. Tuskegee. *Marion Co.:* UMMZ 166390 (1, 55), Luxapallila Cr., 2 mi. W. Winfield. *Lamar Co.:* UMMZ 113908 (2, 21-46), Luxapallila Cr., 7 mi. SW. Vernon. *Autauga Co.:* UMMZ 146538 (1, 53), trib. Beaver Cr., 5 mi. W. Autaugaville. *Perry Co.:* UMMZ 110500 (1, 86), trib. Cahaba R., Federal Hatchery Grounds, Marion. *Counties unknown:* UMMZ 111236 (2, 41-43), Saugahatchee Cr.; UMMZ 111234 (1, 55), Sucarnoochee Cr., trib. Tombigbee R., SE. Coatopa. **Mississippi.**—*Monroe Co.:* UMMZ 157449 (2, 27-29), Tombigbee R., 2.5 mi. N. Amory.

Black Warrior River Drainage

Alabama.—*Tuscaloosa Co.:* CU 21885 (1, 38), Carrol Cr., 8 mi. N. Northport; CU 21893 (1, 55), Blue Cr., 25 mi. N. Tuscaloosa Co. line on Crab Rd.; CU 21913 (1, 45), Pyro Cr., 4 mi. E. New Lexington, 1 mi. N. Sterling; CU 22047 (5, 33-57), 16.2 mi. N. Black Warrior R. Bridge at Tuscaloosa; CU 19621 (10, 37-59), Lower Cottondale Cr. near entrance to Hurricane Cr.; CU 13788 (10, 40-82), trib. Black Warrior R., at E. city limits Cottondale; CU 21917 (7, 40-66), trib. Black Warrior R., 29 mi. NE. Northport, 3 mi. NE. North River Bridge; TU 4161 (2, 28-31), above Lock 9, 17.5 mi. SSW. Tuscaloosa; UMMZ 166374 (3, 36-61), trib. 11.2 mi. N. Tuscaloosa, 5.5 mi. S. Samantha; UMMZ 166364 (3, 38-49), trib. 5 mi. N. Tuscaloosa. *Hale Co.:* CU 22048 (1, 55), S. Branch Big Brush Cr., 1 mi. N. Sawyersville; CU 21904 (2, 40-45), N.

Branch Hines Cr., 3 mi. S. Sawyersville; CU 21911 (2, 40-45), SE. fork Hines Cr., 3 mi. S. Sawyerville; CU 21887 (3, 30-50), in Moundville. *Jefferson Co.:* CU 21918 (2, 62-65), Mud Cr., 10 mi. E. Lock 17, 3 mi. W. Oak Grove. *Blount Co.:* USNM 162303 (6, 53-93), trib. Mulberry Fork, Blount Springs, 7.7 mi. SW. Garden City; UMMZ 158289 (8, 26-74), trib. Locust Fork, 3 mi. NNE. Oneonta. *Cullman Co.:* UMMZ 158263 (20, 32-72), Duck Cr., trib. Mulberry Fork, 12.7 mi. NE. Cullman. *Green Co.:* CU 13992 (1, 32), trib. Black Warrior R., 10.1 mi. E. Eutaw.

Coosa River Drainage

Alabama.—*Cherokee Co.:* CU 18588 (2, 20-59), Cowans Cr., trib. Coosa R., 7.4 mi. WNW. Forney, 6.5 mi. SE. Centre; CU 21157 (1, 65), trib. Terrapin Cr., at Cherokee-Calhoun Co. line; UMMZ 157945 (3, 59-93), small stream S. part Canton. *Talledega Co.:* CU 21260 (2, 49-52), Cheaha Cr., 3.3 mi. SW. Munford; UMMZ 139138 (14, 26-67), Talledega Cr., about 4 mi. S. Talledega. *Etowah Co.:* UMMZ 96775 (1, 48), Coal Cr., about 5 mi. from Gadsden (prob. Cone Cr.); USNM 16233 (3, 56-63), Coosa R., 6.4 mi. SW. Attalla. **Georgia.**—*Bartow Co.:* CU 11799 (4, 54-73), Stamp Cr., 0.3 mi. above junct. with McKaskey Cr.; CU 21279 (1, 69), trib. Etowah R., 3.9 mi. W. Kingston; CU 21234 (1, 53), trib. Etowah R., 7.7 mi. S. Adairsville; UMMZ 157933 (1), Alatoona Cr., 8.2 mi. SE. Cartersville. *Murray Co.:* CU 21192 (2, 53-9), Conasauga R., Whitfield-Murray Co. line. *Gordon Co.:* CU 18231 (1, 47), Sallacoa Cr., trib. Oostanula R., 6.5 mi. E. Sonoraville; UMMZ 239127 (3, 19-22), Oostanula R., at mouth of Spring Branch. *Cobb Co.:* CU 17644 (10, 45-91), trib. Alatoona Cr., 3.9 mi. NW. Kennesaw; CU 21178 (5, 44-59), trib. Alatoona Cr., 0.4 mi. SE. Acworth; UMMZ 88288 (2, 59-60), E. branch Alatoona Cr., 1.1 mi. S. Acworth. *Floyd Co.:* CU 17418 (1, 71), trib. Oostanula R., 11.7 mi. NE. Rome; USNM 162377 (3, 59-80), trib. Coosa R., 12 mi. SW. Rome; UMMZ 88268 (5, 15-57), Spring Cr., about 10 mi. E. Rome; UMMZ 88232 (1, 28), trib. Coosa R.; UMMZ 88242 (1, 28), Armuchee Cr. *Dawson Co.:* CU 21329 (1, 51), Amicalola Cr., 3.4 mi. W. junct. Rtes. 183 and 53; UMMZ 88222 (1, 39), trib. Conosauga R., 15 mi. W. Cleaveland. **Alabama.**—*Escambia Co.:* CU 11834 (5, 36-45), Bushy Cr., trib. Perdido R., 2.9 mi. SW. Atmore. **Florida.**—*Escambia Co.:* TU 1781 (13, 33-58), trib. Perdido R., 4.6 mi. N. Muscogee; TU 1786 (1, 52), trib. Perdido R., Meatosia Cr., 0.1 mi. N. junct. Rtes. 99 and 196; UMMZ 134606 (2, 45-63), Perdido Cr., near Pineville; UMMZ 166174 (6, 28-47), Jach Branch, 3 mi. N. Muscogee; UMMZ 166189 (6, 33-50), small Cr., 4.5 mi. N. Muscogee.

Conecuh-Escambia Rivers Drainage

Alabama.—*Escambia Co.:* CU 14005 (25, 45-62), Franklin Mill Cr., 3.9 mi. SW. Brewton; CU 13972 (2, 35-38), Escambia Cr., trib. Escambia R., 2.4 mi. W. Pollard; UMMZ 163555 (19, 20-46), Big

Escambia Cr., below Rte. 31 bridge, Flomaton; UMMZ 155517 (3, 44-48), Bear Cr., 21 mi. S. Castleberry. *Pike Co.:* CU 14037 (4, 49-53), trib. Conecuh R., 8.2 mi. W. Troy *Conecuh Co.:* CU 16148 (5, 46-65), Jay Branch, Mill Cr., 2.4 mi. E. Evergreen; CU 16202 (8, 44-76), Boggy Branch, trib. Sepula R., 4.8 mi. SW. McKensie. *Crenshaw Co.:* TU 2584 (4, 49-56), trib. Patsaliga R., 2.0 mi. W. Luverne. *Butler Co.:* UMMZ 139157 (3, 33-70), Rocky Cr., 1.0 mi. N. Georgiana, 2.8 mi. S. Chapman; UMMZ 88728 (1, 32), Persimmon Cr.

Blackwater River Drainage

Florida.—*Okaloosa Co.:* CU 12663 (1, 44), Blackwater R., 4.3 mi. NW. Baker; CU 16710 (25, 45-70), trib. Blackwater R., 100 yds. E. Santa Rosa-Okaloosa Co., line. *Santa Rosa Co.:* CU 12603 (5, 41-46), W. fork Coolwater Cr., trib. Blackwater R., 3.5 mi. E. Jay; CU 16682 (6, 43-55), trib. Coldwater Cr., 13.1 mi. N. Milton; CU 16689 (10, 35-65), trib. Blackwater R., 8.7 mi. E. junct. Rtes. 87 and 4; UMMZ 155504 (1, cr. at Milton; UMMZ 16531 (44, 23-69), Sweetwater Cr., trib. Juniper Cr., trib. Blackwater R., near Munson; UMMZ 166221 (1, 44), small cr., 3 mi. NE. Milton.

Yellow River Drainage

Florida.—*Walton Co.:* CU 12124 (10, 48-64), trib. Shoal R., 5.9 mi. NW. De Funiak Springs; CU 20749 (14, 43-59), trib. Shoal R., 6.6 mi. S. Florida; TU 1746 (13, 33-62), Pine Log Cr., 9.1 mi. E. Rte. 85; TU 1725 (1, 53), Middle Cr., 0.8 mi. SE. Liberty; UMMZ 166248 (4, 48-61), Pond Cr., 4 mi. SW. Florala, Ala.; UMMZ 166352 (18, 26-59), Big Swamp Cr., at Liberty. *Okaloosa Co.:* CU 12155 (1, 34), Yellow R., 3.2 mi. E. Crestville; TU 3150 (3, 48-57), trib. Yellow R., 2.9 mi. E. Rte. 85; TU 3715 (5, 28-42), trib. Yellow R., 2.7 mi. E. Blackman; UMMZ 110482 (2, 40-57), Bull Cr., trib. Yellow R., 11 mi. NE. Niceville.

Choctawhatchee River Drainage

Alabama.—*Dale Co.:* CU 16120 (2, 60-61), trib. Claybank Cr., 2.0 mi. W. Ozark; TU 3705 (1, 55), trib. 7.2 mi. NNW. junct. Echo Farm Rd. and Rte. 136; TU 4034 (1, 62), trib., 3.7 mi. W. junct. Rtes. 66 and 84, 1.7 mi. E. Clayhatchee; UMMZ 88689 (4, 23-48), 9 mi. S. Ozark. *Henry Co.:* CU 17146 (3, 46-52), Choctawhatchee R., 5.0 mi. W. Grabell; TU 3903 (1, 40), Blackwood Cr., 3.0 mi. NW. Echo Farm Rd. *Houston Co.:* CU 20747 (7, 49-74), trib. Choctawhatchee R., 5.7 mi. W. Dothan; TU 2504 (3, 36-46), Panther Cr., trib. Little Choctawhatchee R., 3 mi. W. Pinckard Farm Rd. *Geneva Co.:* TU 2386 (4, 38-56), trib. Choctawhatchee R., 2.8 mi. N. Hartford; TU 2422 (5, 39-64), trib. Choctawhatchee R., 1.8 mi. N. Black; TU 1698 (1, 51), trib. Choctawhatchee R., 5.2 mi. N. Black; TU 2438 (1), Adams Cr., 6.5 mi. S. Bellwood. *Pike Co.:* TU 3209 (8, 43-59), trib. Buckhorn Cr., 7.1 mi. S. Perote. **Florida.**—*Holmes Co.:* CU 12115 (8, 36-67), Sandy Cr., trib. Choctawhatchee

R., Ponce de Leon; CU 20748 (2, 56-65), Holmes Cr., 4 mi. E. Bonifay; CU 20750 (6, 38-62), trib. Choctawhatchee R., 7.2 mi. E. De Funiak Springs; TU 1585 (25, 40-69), Holmes Cr., trib. Choctawhatchee R., S. limits Ponce de Leon; TU 187 (4, 39-62), trib. Choctawhatchee R., 4.7 mi. SSE. Geneva; TU 2457 (2, 39-42), East Pittman Cr., 1.5 mi. N. Miller Crossroads; Tu 1095 (2, 41-45), Pine Log Cr., trib. Choctawhatchee R., 12.4 mi. SSW. Geneva; TU 2275 (50, 34-72), trib. Choctawhatchee R., 3.5 mi. NW. junct. Rtes. 79 and 77; TU 3357 (3, 33-37), Blue Cr., Ponce de Leon; TU 2480 (5, 44-60), Little Cr., trib. Ten Mile Cr., 6.5 mi. NNW. junct. Rtes. 79 and 177; FSU 119 (53, 55-67), Wrights Cr., 5.9 mi. N. Bonifay; UMMZ 163504 (13, 30-67), Blue Cr., Ponce de Leon; UMMZ 166302 (2, 52-56), Wrights Cr., 2.6 mi. W. Graceville; UMMZ 166319 (46-76), Parrott Cr., 6 mi. SW. Geneva. *Walton Co.:* TU 1692 (1, 56), Turnpike Bridge, Camp Cr., trib. Black Cr., 3.6 mi. E. Freeport; TU 306 (3, 45-60), Four Mile Cr., trib. Lafayette Cr., 0.7 mi. W. Freeport; TU 1072 (5, 35-44), Black Cr., 1.5 mi. W. Bruce; FSU 127 (4, 44-59), Lafayette Cr., 0.7 mi. E. Freeport. *Okaloosa Co.:* TU 2078 (19, 38-93), Toms Cr., 1 mi. SW. Valparaiso. *Washington Co.:* TU 3644 (10, 25-58), Pine Log Cr., 2.5 mi. SE. Ebro; TU 1099 (2, 52-66), trib. Holmes Cr., 8.5 mi. W. Chipley; FSU 120 (5, 42-71), Pine Log Cr., 2.5 mi. S. Ebro.

St. Andrews Bay Drainage

Florida.—*Bay Co.:* CU 12563 (1, 37), trib. Bear Cr., 0.5 mi. W. Youngstown; CU 12670 (1, 59), Econfina R., 8.2 mi. W. Youngstown; TU 79 (3, 44-63), trib. Econfina R., Youngstown.

Apalachicola Bay Drainage

Alabama.—*Russell Co.:* CU 11838 (5, 33-64), trib. Little Uchee Cr., 0.9 mi. E. Crawford; CU 16193 (5, 34-62), Uchee Cr., trib. Chattahoochee R., 9.2 mi. S. Phoenix City; CU 15828 (11, 42-55), trib. Hatchehubee Cr., 4.0 mi. SW. Seale; CU 13978 (10, 38-56), trib. Uchee Cr., 3.1 mi. W. Marvyn; UMMZ ..... (22, 20-59), Watoolee Cr., trib. Uchee Cr., S. Marvyn. *Barbour Co.:* CU 16100 (1, 51), trib., Chattahoochee R., 5.1 mi. SW. Eufala; CU 16107 (2, 31-53), trib. Chattahoochee R., 9.8 mi. SW. Eufala; CU 16089 (1, 44), Barbour Cr., trib. Chattahoochee R., 2.3 mi. S. Eufala. *Henry Co.:* CU 17484 (3, 50-57), trib. Abbie Cr., 1.2 mi. E. Abbieville. *Houston Co.:* CU 17768 (1, 47), Chipola R., 0.9 mi. NW. Grangeburg; CU 17664 (24, 37-68), Osmussee Cr., 5.8 mi. NE. Dothan; TU 2317 (3, 21-62), Irwin Mill Cr., trib. Chattahoochee R., 1.9 mi. N. Rte. 2 on dirt rd.; TU 2339 (15, 40-74), Howards Mill Cr., 1.2 mi. SE. Gordon; TU 3320 (2, 51-64), Bryans Cr., trib. Chattahoochee R., 3.4 mi. S. junct. Rtes. 2 and 83; TU 2320 (5, 42-48), trib. Chattahoochee R., 4.2 mi. N. Gordon; TU 2339 (3, 48-62), trib. Chattahoochee R., 1.0 mi. N. Gordon; TU 2527 (4, 40-46), trib. Chattahoochee R., 4.6 mi. N. Gordon; UMMZ 128751 (10, 39-62), Brush

Cr., trib. Uchee Cr., S. Marvyn. *Lee Co.:* CU 15998 (4, 50-84), Uchee Cr., trib. Chattahoochee R., 0.7 mi. E. Marvyn; UMMZ 111235 (1, 65), 6 mi. W. Auburn. **Georgia.**—*Hall Co.:* CU 15808 (17, 42-60), trib. Upatoi Cr., 6.9 mi. S. Talbottom; CU 19821 (3, 57-65), trib. Chestatee R., 1 mi. SE. Murrayville; CU 11007 (9, 37-69), trib. Chattahoochee R., 6 mi. N. Gainesville. *Stewart Co.:* CU 17115 (1), Pataula Cr., 12.3 mi. N. Cuthbert; CU 15874 (1, 52), Hodghodkee Cr., trib. Pataula Cr., 19.4 mi. N. Cuthbert; CU 17777 (10, 32-85), Hannahatchee Cr., 8.1 mi. N. Lumpkin. *Habersham Co.:* CU 17435 (11, 56-77), trib. Chattahoochee R., 2.7 mi. E. of Chattahoochee R.; CU 22055 (16, 40-62), Tenner Branch near Cornelia; CU 17438 (8, 52-79), trib. Soque R., 1 mi. W. Soque; CU 10930 (1, 43), trib. Soque R., 3 mi. NE. Clarksville. *Lumpkin Co.:* CU 10991 (4, 48-73), Cane Cr., 1.6 mi. WSW. Dahlonega; CU 17163 (4, 60-72), trib. Chattahoochee R., 2.2 mi. W. Fort Gaines; CU 19620 (20, 38-63), Chestatee R., at mouth Yahoola Cr., 2.1 mi. SE. Dahlonega; CU 10997 (24, 54-62), Chestatee R., at Walnut, 9 mi. NNE. Dahlonega; CU 21415 (2, 52-54), Cane Cr., 1.5 mi. SW. Dahlonega; CU 21451 (33), Yahoola Cr., 1.1 mi. E. Dahlonega; CU 19629 (11, 41-66), Wards Cr., trib. Yahoola Cr., 4 mi. NE. Dahlonega; CU 19805 (30, 41-75), Yahoola Cr., 1 mi. E. Dahlonega; UMMZ 136091 (14, 19-60), Chestatee R., 9.5 mi. NW. Cleveland; UMMZ 94585 (3, 33-45), Chestatee Cr., headwater Chattahoochee R.; UMMZ 136090 (9, 35-53), trib. Chattahoochee R., below Rte. 43, E. Dahlonega; UMMZ 157962 (3, 31-42), Cane Cr., trib. Chestatee R., 1.3 mi. WSW. Dahlonega. *Early Co.:* CU 20751 (12, 37-90), trib. Chattahoochee R., 9.1 mi. W. Donaldsonville; UMMZ 88684 (8, 25-43), trib. Chattahoochee R. *Harris Co.:* CU 17517 (1), trib. Mulberry Cr., 7.7 mi. E. Hamilton; CU 17530 (25, 43-79), trib. Mulberry Cr., 0.5 mi. W. Hamilton; UMMZ 157879 (2, 28--43), Mulberry Cr., 3.5 mi. S. Hamilton; UMMZ 157886 (1, 58), Mountain Cr., 2.5 mi. SE. Chipley; UMMZ (5, 65-70), Chattahoochee R., 4 mi. above Helen. *Troup Co.:* UMMZ 157895 (2, 35-37), Flat Shoal Cr., 7.2 mi. SW. Chipley. *Fulton Co.:* CU 17533 (1, 45), Nancy Cr., on Wieuca Rd., 2 mi. N. Buckhead; CU 17126 (3), Vickery Cr., at junct. with Chattahoochee R., at city limits of Roswell; UMMZ 88299 (2, 35-38), Nancy Cr., 10 mi. N. Atlanta. *Henry Co.:* CU 17762 (1, 43), trib. Abbie Cr., 2.6 mi. S. Abbieville; CU 17484 (3, 50-57), trib. Abbie Cr., 1.2 mi. E. Abbieville. *Lee Co.:* CU 15998 (4, 50-84), Uchee Cr., trib. Chattahoochee R., 0.7 mi. E. Marvyn. **Florida.**—*Calhoun Co.:* TU 2047 (1, 59), trib. Apalachicola R., 2.9 mi. NE. Blountstown; FSU 124 (10, 41-54), Four Mile Cr., 0.6 mi. N. Clarksville; FSU 125 (6, 45-55), Ten Mile Cr., 4.7 mi. N. Clarksville. *Jackson Co.:* TU 2374 (110, 40-64), Russ Cr., trib. Waddells Mill Cr., 6.3 mi. S. Campbellton; TU 3220 (6, 39-60), trib. Chipola R., 7.2 mi. SE. Marianna; TU 2568 (6, 38-53), trib. Chipola R., 1.1 mi. S. Marianna. *Bay Co.:* CU 18150 (1, 56), cr., 8.2 mi. E. junct. Rtes. 98 and 22, toward Wewahitchka; CU

18121 (2, 37-39), Sandy Cr., W. Wewahitchka. *Gadsden Co.:* UMMZ 166267 (23, 40-78), Mosquito Cr., 1.5 mi. E. Chattahoochee.

Flint River Drainage

Georgia.—*Sumter Co.:* CU 22099 (21, 38-65), trib. Muckalee Cr., 3.4 mi. N. junct. Rtes. 19 and 280 at city limits of Americus; CU 15841 (2), trib. Flint R., 13.9 mi. NE. Americus. *Talbot Co.:* CU 21131 (2, 51-60), trib. Lazier Cr., 2.9 mi. W. Talbottom. *Baker Co.:* CU 17317 (10, 40-77), Coolawahee Cr., trib. Flint R., 1.3 mi. N. Newton; UMMZ 164071 (4, 38-58), Chickasawatchee Cr., 5 mi. S. Calhoun Co. line, 1 mi. E. Rte. 37. *Macon Co.:* CU 15881 (1, 67), trib. Hogcrawl Cr., 4.7 mi. E. junct. Rtes. 90 and 26. *Schley Co.:* CU 21101 (5), trib. Bucks Cr., 7.4 mi. N. Ellaville; CU 22100 (14, 40-82), 0.2 mi. E. Ellaville. *Terrell Co.:* CU 15794 (3, 53-65), trib. Chickasawatchee Cr., 0.2 mi. W. Dawson. *Randolph Co.:* CU 17755 (1), trib. Carter Cr., 3.3 mi. C. Cuthbert. *Taylor Co.:* CU 21146 (3, 34-45), Cedar Cr., 11 mi. N. Ellaville, 4.0 mi. S. Rupert. *Lee Co.:* UMMZ 163914 (2, 45-57), Flint R., island stretch, 100 yds. above and below ent. Abrams Cr., 11 mi. NE. power dam on N. side Albany. *Worth Co.:* UMMZ 164014 (1), Abrams Cr., N. Albany; UMMZ 163983 (1), Mill Cr., between Abrams Cr., and Piney Woods Cr., 11 mi. NE. Albany. *Dougherty Co.:* UMMZ 163958 (1, 50), Flint R., below power dam N. Albany on old Leesburg Rd.; UMMZ 164085 (1, 63), Chickasawhatchee Cr., 4 mi. SW. Docker.

Ochlockonee River Drainage

Georgia.—*Colquitt Co.:* CU 17309 (1, 77), Little Ochlockonee R., 0.7 mi. W. Hartsfield. *Grady Co.:* CU 20758 (1, 39), trib. Ochlockonee R., 5.8 mi. W. junct. Rtes. 84 and 93, N. Cairo; CU 20753 (14, 35-56), Ochlockonee R., 1.6 mi. E. Cairo; UMMZ 88671 (9), 3 mi. E. Climax. **Florida.**—*Liberty Co.:* CU 17175 (5, 40-82), Small Sandy Cr., W. Greensboro, trib. Taluga R., 0.9 mi. W. Co. line. *Leon Co.:* CU 12368 (8, 30-39), trib. Ochlockonee R., 19 mi. W. Tallahassee; FSU 123 (5, 42-61), Telogia Cr., 3.1 mi. E. Bristol. *Gadsden Co.:* CU 18182 (2, 55-56), Taluga R., 1.5 mi. W. Gretna; FSU 120 (4, 40-59), Rocky Comfort Cr., 3.2 mi. ENE. Wetumpka 0. 9. mi. S. Quincy, on dirt rd. near grist mill; FSU 121 (4, 39-56), Monroe Cr., 3.0 mi. WNW. Midway on dirt rd.; CU 18184 (1, 63), trib. Little R., 2.1 mi. W. Little R. Bridge, W. Havana.

St. Marks River Drainage

Florida.—*Jefferson Co.:* CU 12383 (1), trib. St. Marks R., 6.9 mi. W. Wakeenah; FSU 52 (25, 45-59), Lloyd Cr., 0.8 mi. E. main intersection in Lloyd, third bridge E. of town; TU 222 (25, 36-59), trib. L. Miccosukee, 0.8 mi. E. Lloyd, 17.0 mi. E. Tallahassee; TU 2666 (2, 41-54), trib. L. Miccosukee, 4.6 mi. E. junct. Rtes. 90 and 59, 1.8 mi. E. outlet. *Wakulla Co.:* FSU 50 (6, 51-75), Wakulla R., 2.3 mi. SW. Wakulla RR sta.; FSU 126 (6, 41-59), under bridge,

2.3 mi. SW. Wakulla RR sta.; USNM 92884 (1, 53), Wakulla R., near Wakulla Springs; TU 2360 (1, 51), Wakulla R., at Rte. 319 crossing.

Suwannee River Drainage

Georgia.—*Wilcox Co.:* CU 17407 (1, 56), trib. Alapaha R., 0.6 mi. W. Pitts. *Alachua Co.:* CU 10196 (1, 35), Santa Fe R., at Poe Springs. *Cook Co.:* CU 15768 (1, 49), New R., trib. Withaloochee R., 4.9 mi. W. Nashville. *Lanier Co.:* CU 15440 (7, 42-53), Five Mile Cr., trib. Alapaha R., at E. limits Lakeland. **Florida.**—*Columbia Co.:* CU 12502 (83, 20-66), trib. Suwannee R., 2 mi. S. Benton. *Union Co.:* TU 2994 (5, 49-52), trib. Santa Fe. R., 9.4 mi. E. junct. Rtes. 18, 441 and 41. *Alachua Co.:* UMMZ 87911 (1, 70), Santa Fe. R. at Poe Springs; UMMZ 101676 (3, 43-61), Santa Fe R., at Poe Springs. *Hamilton Co.:* UMMZ 163311 (34, 22-73), small trib. N. Suwannee R., SE. Genoa. *Gilcrist Co.:* KS (5, 37-46), Suwannee R., at Rock Bluff Ferry near Rock Bluff Springs.

Suwannee Springs Drainage

Florida.—*Columbia Co.:* KS (12, 50-69), Ichtuckney Springs, downriver, above second large spring; KS (13, 54-68), Ichtuckney Springs, down run above entrance second large spring; KS (6, 47-64), Ichtuckney Spring, near boil.

St. Johns River Drainage

Florida.—*Lake Co.:* CU 12026 (44, 21-51), 1.5 mi. W. Cassia, Blackwater Swamp; KS (25, 37-70), Seminole Springs Run. *Clay Co.:* 12434 (1, 57), Clark Cr., trib. St. Johns R., 7.3 mi. N. Bostwick; CU 21099 (5, 36-56), trib. S. fork Black Cr., 12 mi. S. Clay Co. line. *Seminole Co.:* CU 19825 (5, 49-69), Wekiva R., trib. St. Johns R., 9.7 mi. W. San Ford; CU 22096 (16, 30-55), Howells Cr., 2.9 mi. E. Wagner, 7.3 mi. ENE. Fern Park; CU 21130 (1, 61), trib. L. Jessup, 2.6 mi. E. junct. Rtes. 419 and 17. *Orange Co.:* USNM 13343 (1, 68), Rock and Silver Springs. *Putnam Co.:* UF 113 (8, 38-50), Little Orange Cr., 6 mi. S. Johnson. *Marion Co.:* UF (13, 32-51), Orange Cr., at Orange Spring; UMMZ 163328 (4, 38-44), Juniper Springs at head Juniper Cr., Ocala Nat. For.

Altamaha River Drainage

Georgia.—*Tatnall Co.:* CU 15766 (39, 42-67), Brazells Cr., trib. Ohoopee R., 2.3 mi. W. Reidsville; CU 20752 (3, 58), trib. Altamaha R., 13.6 mi. S. Claxton; CU 20754 (5, 36-55), trib. Altamaha R., 11.9 mi. S. Claxton. *Toomis Co.:* CU 21465 (1, 57), Cobb Cr., 15.7 mi. N. Baxley; UMMZ 158077 (2, 61-62), Rocky Cr., trib. Tendleton Cr., 6 mi. SW. Lyons. *Telfair Co.:* CU 17256 (3, 46), Little Ocmulgee R., 1.2 mi. N. Mc Rae. *Henry Co.:* CU 18461 (1, 36), trib. Cotton R., 6.6 mi. NW. Mc Donough. *Wheeler Co.:* CU 18461 (3, 35-52), trib. Oconee R., 1.5 mi. ENE. Glenwood. *Emmannuel Co.:* USNM 162456 (3, 47-63), Ohoopee R., 2.5 mi. N.

Oak Park; UMMZ 88421 (1, 25), Ohoopee R., 15 mi. S. Swainsboro. *Bibb Co.:* UMMZ 88323 (3, 26-30), Tobesofkee Cr., trib. Ocmulgee R., 5 mi. S. Macon. *Laurens Co.:* UMMZ 88382 (1, 43), Hunger and Hardship Cr., 5 mi. SW. Dublin; UMMZ 88377 (5, 17-38), Rocky Cr., 2 mi. from Beckley Co. line near Dudley. *Oconee Co.:* CU 22002 (3, 41-66), high shoals below dam Apalachee R.

Ogeechee River Drainage

Georgia.—*Bullock Co.:* CU 21757 (1, 50), trib. Ogeechee R., 2.4 mi. NE. Statesboro; CU 17470 (1, 54), Lotts Cr., trib. Ogeechee R., 7.4 mi. S. Statesboro. *Jefferson Co.:* CU 17274 (2, 87), trib. Ogeechee R., 6 mi. S. Wrens. *Candler Co.:* CU 17244 (6, 26-52), Fifteen Mile Cr., trib. Ogeechee R., 3.5 mi. W. Pulaski. *Evans Co.:* CU 20755 (21, 39-58), trib. Canoochee R., 1.1 mi. NW. Claxton.

Mid-Savannah River Drainage

Georgia.—*Jefferson Co.:* CU 18587 (7, 50-79), Ready Cr., 3.9 mi. NE. Wrens; CU 18586 (19, 41-61), Brush Cr., 0.4 mi. S. Wrens; CU 17380 (10, 44-55), Bushy Cr., trib. Briar Cr., 0.9 mi. S. Wrens. *Richmond Co.:* CU 17624 (54, 32-66), trib. Butler Cr., 1 mi. SW. Augusta city limits; CU 17213 (6, 41-52), Boggy Gut Cr., trib. Briar Cr., 22.5 mi. SW. Augusta; USNM 162472 (1, 68), Briar Cr., 6.7 mi. E. Wrens; UMMZ 158021 (8, 25-52), 6.0 mi. NNW. Augusta; UMMZ 132764 (1), Spirit Cr., 12 mi. S. Augusta, below Mc Dades pond. *Severen Co.:* CU 20756 (1, 52), trib. Savannah R., 12.9 mi. S. Savannah R. **South Carolina.**—*Allendale Co.:* CU 15142 (2, 55-56), trib. lower Three R., 3.6 mi. NW. Appleton. *Aiken Co.:* USNM 16255 (2, 42-64), upper Three R., below Rte. 28; UMMZ 145321 (1, 43), Horse Cr., Bath; HF (9, 56-87), stream below dam of pond, Henrys L.

Upper Savannah River Drainage

South Carolina.—*Abbeville Co.:* CU 19656 (4, 34-53), Little R., 5.6 mi. E. Calhoun Falls; CU 19603 (2, 40-49), Long Cave Cr., 4.4 mi. E. Abbeville; CU 19781 (3, 60-63), Savannah R., 4 mi. W. Calhoun Falls; CU 19599 (42, 45-81), Calhoun Cr., 7.6 mi. E. Calhoun Falls. *Anderson Co.:* CU 19603 (15, 60-80), Twentythree Mile Cr., 0.9 mi. NW. Sandy Springs, 11.1 mi. NW, Anderson. *Oconee Co.:* CU 10925 (2, 37-41), trib. Coneross Cr., 5.3 mi. S. Seneca; CU 19737 (6, 38-52), Keowee R., 13.2 mi. SW. Pickens. *Elbert Co.:* CU 19722 (1, 59), Morea Cr., 1.3 mi. S. Nuberg. *Franklin Co.:* CU 19623 (1, 61), trib. Nail Cr., 9.9 mi. NE. Commerce, 0.7 mi. SW. Ashland; USNM 34005 (1), Columbia. *Pickens Co.:* CU 19069 (4, 60-67), trib. Keowee R., E. crossing on Rte. 28, 10 mi. S. N.C. State Line. **Georgia.**—*Madison Co.:* CU 20762 (20, 47-67), Anthony Shoals, S. fork Broad R.

Combahee River Drainage

South Carolina.—*Allendale Co.:* CU 15320 (15, 47-79), Jack-

son Branch, trib. Combahee R., 1.8 mi. S. Sycamore. *Barnwell Co.:* CU 20761 (3, 40-50), trib. Salkehatchee R., 2.6 mi. W. Olar *Bamberg Co.:* CU 20760 (8, 53-76), trib. Salkehatchee R., 2.1 mi. S. Olar.

Edisto River Drainage

South Carolina.—*Orangeburg Co.:* CU 20759 (1, 70), Edisto R., 10.3 mi. SW. Orangeburg. *Aiken Co.:* CU 15135 (18, 40-76), trib. S. fork Edisto R., 11.9 mi. N. Aiken; CU 71949 (9, 39-50), trib. S. fork Edisto, 3.9 mi. N. Aiken.

PERCINA NIGROFASCIATA (AGASSIZ)

Range and habitat.—Mississippi River system, Louisiana, to Edisto River system, South Carolina; southward into peninsular Florida, throughout the St. Johns and Suwannee River system (Map 1).

P. nigrofasciata is found in the currents of streams and rivers throughout the coastal plain and piedmont region. It is also present in mountain tributaries of Alabama, Georgia and South Carolina. Sandy, rock or rubble bottoms are preferred, but specimens may be taken over mud or silt bottoms in the lower coastal plain drainages.

Diagnosis.—A species of *Percina* with discrete, elliptical dark lateral bars. Scales in the lateral line, 46 to 71 (usually[2] 50 to 62). The nape, cheeks, and opercles are fully scaled. The sub-triangular muscle mass between the pelvic fins is often scaled, and the breast is sometimes scaled. Dorsal fin rays number IX to XV, 10 to 13 (usually XI to XIII, 11 to 12); total pectoral rays number 23 to 32 (usually 27 to 30); anal fin II, 7 to 10 (usually 9). The preopercle is usually entire but may be serrulate. Seven dark dorsal blotches are present; three dark spots at the base of the caudal fin; sub-ocular bar present or absent.

Description.—The various body proportions appear in Tables 9-14. Other descriptive features follow. The body is moderately compressed to terete. The length of the head, including the fleshy opercular membrane is somewhat elongate. The depth of the caudal peduncle is somewhat narrow.

The dorsal fins are high and well developed. The anal fin is high. The pectoral fins are well developed and are moderate in length. The pelvic fins are moderate to slightly short in length and are well developed. The snout is short, slightly bulbous, projects upward from the anterior margin of the orbit, then slopes downward from the anterior nostril.

Teeth are present on the premaxillary, vomer and palatine bones. The teeth of the upper jaw are located along the contour of the jaw. There is present, one outer row of enlarged conical teeth and behind this single row of large teeth lies a crescent-shaped row of smaller

[2] The majority of counts fall between one standard deviation on either side of the mean.

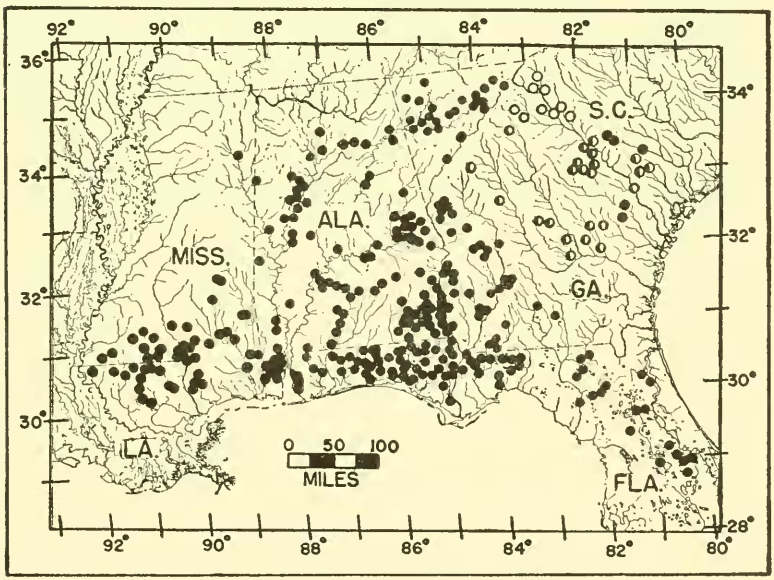
TABLE 1.

FREQUENCY DISTRIBUTIONS OF LATERAL LINE SCALES OF SEVERAL POPULATIONS OF *Percina nigrofasciata* BY DRAINAGE SYSTEMS

	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	52	52	51	50	49	48	47	46	N	$\bar{x}$	SD	SE
nigrofasciata																														
Mississippi	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1			
L. Pontchartrain	—	—	—	—	—	—	—	—	3	4	4	6	9	10	3	6	5	4	4	1	—	—	—	—	—	—	59	57.9	2.9	0.38
Pearl & Wolf	—	—	—	—	—	—	—	—	—	6	6	12	17	19	30	29	38	19	9	9	2	2	—	—	—	—	197	56.3	2.5	0.18
Pascagoula	—	—	—	—	—	—	—	—	—	1	3	4	5	10	11	4	10	16	7	5	3	2	3	—	—	—	84	55.4	3.0	0.33
Mobile Bay	—	—	—	—	—	—	—	—	—	1	4	1	3	6	5	5	16	11	9	11	6	2	1	—	1	1	83	54.5	3.1	0.34
Black Warrior	—	—	—	—	—	—	—	1	3	6	7	9	8	8	10	4	3	4	3	2	—	—	—	—	—	—	68	58.3	2.9	0.37
Coosa	—	—	—	—	—	—	—	1	2	6	7	5	9	4	4	6	7	1	—	2	1	—	—	—	—	—	55	58.4	3.0	0.40
Perdido Bay	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	1	6	3	4	5	4	3	1	—	—	—	29	53.1	2.4	0.45
Conecuh-Escambia	—	—	—	—	—	—	—	—	—	2	2	1	2	3	7	12	3	5	8	2	—	1	—	—	—	—	48	55.9	2.7	0.39
Blackwater	—	—	—	—	—	—	—	—	—	—	—	—	1	—	3	5	6	8	11	12	13	4	6	2	1	—	72	52.5	2.4	0.29
Yellow	—	—	—	—	—	—	—	—	—	—	1	2	2	3	7	8	4	4	2	4	3	3	—	—	—	—	43	55.2	2.9	0.44
Choctawhatchee	—	—	—	—	—	—	—	—	2	2	7	2	12	8	19	14	12	15	7	8	9	6	3	2	—	—	127	55.4	3.4	0.30
St. Andrews Bay	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	—	—	1	—	1	—	—	5	52.0	2.9	1.30
Apalachicola	—	—	—	—	—	1	—	—	1	3	3	11	21	27	49	48	43	39	32	31	30	17	—	—	—	1	336	55.3	2.8	0.16
Flint	—	—	—	—	—	—	—	—	—	—	1	—	—	4	4	6	15	6	7	7	2	2	1	—	—	—	55	54.4	2.3	0.31
Ochlockonee	—	—	—	—	—	—	—	—	—	—	1	1	1	5	5	10	7	3	5	3	2	2	—	—	—	—	45	54.2	2.5	0.38
Apalachee Bay	—	—	—	—	—	—	—	—	—	—	1	2	7	8	10	10	11	8	3	3	2	1	—	—	—	—	66	55.9	2.3	0.29
Suwannee River	—	—	—	—	—	—	—	—	—	—	—	2	5	2	4	5	6	14	18	7	8	10	2	1	1	1	86	53.4	2.9	0.32
Suwannee Springs	—	—	—	—	—	—	—	—	—	1	2	—	3	5	8	4	3	2	1	2	—	—	—	—	—	—	31	56.8	2.4	0.43
St. Johns	—	—	—	—	—	—	4	—	2	4	6	7	14	13	13	7	8	11	8	5	—	1	—	—	—	—	103	57.3	3.2	0.32
Ogeechee	—	—	—	—	—	—	—	—	—	—	—	1	1	2	2	3	4	4	2	4	1	—	—	—	—	—	24	55.8	2.4	0.49
Edisto	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	3	4	4	2	5	3	3	1	—	—	—	27	53.2	2.4	0.46
nigrofasciata x *raneyi*																														
Altamaha	—	—	—	—	—	1	2	—	2	1	2	7	10	3	6	4	3	2	2	—	—	—	—	—	—	—	45	58.6	3.0	0.45
Mid-Savannah	—	—	—	1	—	—	1	4	6	11	6	9	13	11	3	4	4	1	—	—	—	—	—	—	—	—	74	59.9	2.7	0.31
Combahee	—	—	—	—	—	—	—	2	1	1	—	2	4	5	1	4	2	3	—	1	—	—	—	—	—	—	26	57.9	3.1	0.61
raneyi																														
Upper Savannah	3	—	3	3	4	6	16	10	12	14	9	10	2	2	3	1	1	—	—	—	—	—	—	—	—	—	99	63.2	3.2	0.32

teeth. The area of small teeth has its greatest width in the mid-portion of the jaw and tapers in width posteriorly to the end of the row of large teeth. Vomerine teeth are present and well developed. They form a triangular patch on the bone. Palatine teeth are few, but well developed, and are confined to the anterior end of the bone. The dentary teeth resemble those small teeth of the upper jaw which lie behind the first row of enlarged conical teeth. They occur in greatest numbers at approximately one quarter length of the lower jaw posteriorly from the mandibular symphysis, and decrease in number toward the symphysis and also distally from the area of greatest concentration.

Scutellation.—Imbricate ctenoid scales cover most of the body. In some specimens the lower portion of the cheek is naked. Enlarged ctenoid scales are present on the mid-line of males. The nape is nearly always scaled. Often, and especially in specimens over fifty millimeters in length which inhabit the Gulf drainages, the sub-triangular area between the pelvic bones is well scaled. Similarly, the breast of large specimens from Gulf drainages may be well scaled. The opercle is usually completely scaled. One or more enlarged ctenoid scales are present superficial to the junction of the pelvic bones near the mid-portion of the breast, as is the rule in species of



Map 1. Distribution (By Collections) of *Percina nigrofasciata* in the Southeastern United States

● *Percina n. nigrofasciata*

○ *Percina n. raneyi*

◐ *Percina n. nigrofasciata* X *Percina n. raneyi* (Intergrades)

TABLE 2.
FREQUENCY DISTRIBUTIONS OF SCALES ABOVE THE LATERAL LINE OF SEVERAL POPULATIONS OF *Percina nigrofasciata* BY DRAINAGE SYSTEMS

	9	8	7	6	5	4	N	$\bar{x}$	SD	SE
nigrofasciata										
Mississippi	—	—	—	—	1	—	1			
L. Pontchartrain	—	—	23	26	5	—	54	6.3	0.6	0.08
Pearl & Wolf	—	1	39	125	32	—	197	6.1	0.6	0.04
Pascagoula	—	4	29	34	17	—	84	6.2	0.8	0.09
Mobile Bay	—	2	10	44	25	2	83	5.8	0.8	0.08
Black Warrior	—	4	40	18	3	—	65	6.7	0.7	0.08
Coosa	—	2	27	24	2	—	55	6.5	0.6	0.09
Perdido Bay	—	—	—	11	18	—	29	5.4	0.5	0.09
Conecuh-Escambia	—	1	7	30	9	—	47	6.0	0.7	0.10
Blackwater	—	—	—	32	37	3	72	5.4	0.6	0.07
Yellow	—	—	1	25	17	—	43	5.6	0.5	0.08
Choctawhatchee	—	2	22	73	29	1	127	6.0	0.7	0.06
St. Andrews Bay	—	—	—	3	2	—	5	5.6	0.5	0.25
Apalachicola	—	3	67	191	70	—	331	6.0	0.7	0.04
Flint	—	—	5	44	6	—	55	6.0	0.4	0.06
Ochlockonee	—	1	5	30	9	—	45	6.0	0.6	0.09
Apalachee Bay	—	—	13	46	7	—	66	6.1	0.5	0.07
Suwannee River	—	—	7	58	21	—	86	5.8	0.5	0.06
Suwanee Springs	1	5	8	16	1	—	31	6.7	0.9	0.16
St. Johns	—	1	35	44	7	—	87	6.3	0.6	0.07
Ogeechee	—	—	2	11	3	—	16	5.9	0.6	0.14
Edisto	—	—	1	22	4	—	27	5.9	0.4	0.08
nigrofasciata x *raneyi*										
Altamaha	—	3	24	15	3	—	45	6.6	0.7	0.11
Mid-Savannah	—	3	20	44	6	—	73	6.3	0.7	0.08
Combahee	—	—	8	16	2	—	27	6.2	0.6	0.12
raneyi										
Upper Savannah	8	46	37	7	—	—	98	7.6	0.7	0.08

TABLE 3.
FREQUENCY DISTRIBUTIONS OF SCALES BELOW THE LATERAL LINE OF SEVERAL POPULATIONS OF *Percina nigrofasciata* BY DRAINAGE SYSTEMS

	14	13	12	11	10	9	8	7	N	$\bar{x}$	SD	SE
nigrofasciata												
Mississippi	—	—	—	—	—	1	—	—	1			
L. Pontchartrain	—	2	7	21	15	8	1	—	54	10.6	1.1	0.15
Pearl & Wolf	—	1	5	32	69	73	17	—	197	9.7	1.0	0.07
Pascagoula	—	—	1	4	44	30	5	—	84	9.6	0.7	0.08
Mobile Bay	—	—	3	10	27	29	13	1	83	9.5	1.0	0.12
Black Warrior	—	1	24	24	12	—	—	—	61	10.4	0.9	0.11
Coosa	—	—	3	14	21	15	2	—	55	10.0	0.9	0.13
Perdido Bay	—	—	—	—	1	15	10	3	29	8.5	0.7	0.14
Conecuh-Escambia	—	—	—	5	27	13	2	—	47	9.7	0.7	0.10
Blackwater	—	—	1	—	14	31	24	2	72	8.9	0.9	0.10
Yellow	—	—	1	3	12	19	7	1	43	9.3	1.0	0.15
Choctawhatchee	—	—	3	19	34	52	18	1	127	9.5	1.0	0.09
St. Andrews Bay	—	—	—	—	2	2	—	1	5	9.0	1.2	0.55
Apalachicola	—	—	10	43	133	127	17	—	330	9.7	0.9	0.05
Flint	—	—	3	5	14	23	9	—	54	9.4	1.0	0.14
Ochlockonee	—	—	—	3	10	29	3	—	45	9.3	0.7	0.10
Apalachee Bay	—	—	—	8	34	20	4	—	66	9.7	0.8	0.09
Suwannee River	—	—	1	4	30	33	16	2	86	9.2	0.9	0.10
Suwannee Springs	—	—	—	7	20	3	1	—	31	10.1	0.7	0.12
St. Johns	—	2	6	38	29	13	—	—	88	10.5	0.9	0.10
Ogeechee	—	—	—	3	7	13	—	—	23	9.6	0.7	0.15
Edisto	—	—	—	2	11	13	1	—	27	9.5	0.6	0.12
nigrofasciata x *raneyi*												
Altamaha	—	1	10	20	12	2	—	—	45	10.9	0.9	0.13
Mid-Savannah	—	2	10	35	21	6	—	—	74	10.7	0.9	0.10
Combahee	—	—	2	6	14	4	—	—	26	10.2	0.8	0.16
raneyi												
Upper Savannah	1	10	39	36	11	1	1	—	99	11.5	1.0	0.10

TABLE 4.

FREQUENCY DISTRIBUTIONS OF SCALES ABOVE PLUS BELOW THE LATERAL LINE OF SEVERAL POPULATIONS OF *Percina nigrofasciata* BY DRAINAGE SYSTEMS

	22	21	20	19	18	17	16	15	14	13	12	11	N	$\bar{x}$	SD	SE
nigrofasciata																
Mississippi	—	—	—	—	—	—	—	—	1	—	—	—	1			
L. Pontchartrain	—	—	2	4	15	12	11	7	3	—	—	—	54	16.9	1.5	0.20
Pearl & Wolf	—	—	—	4	12	41	49	57	29	5	—	—	197	15.7	1.3	0.09
Pascagoula	—	—	—	1	3	28	20	15	15	2	—	—	84	15.8	1.3	0.14
Mobile Bay	—	—	—	3	5	8	18	23	19	5	2	—	83	15.3	1.5	0.17
Black Warrior	—	—	2	3	22	20	10	6	3	—	—	—	66	17.1	1.3	0.16
Coosa	—	—	—	5	7	15	18	6	4	—	—	—	55	16.2	1.3	0.18
Perdido Bay	—	—	—	—	—	—	—	9	10	7	3	—	29	13.9	1.0	0.18
Conecuh-Escambia	—	—	—	—	2	9	16	15	5	—	—	—	47	15.7	1.0	0.15
Blackwater	—	—	—	—	1	—	13	10	33	12	1	2	72	14.3	1.2	0.14
Yellow	—	—	—	—	1	4	5	19	9	4	1	—	43	14.9	1.3	0.20
Choctawhatchee	—	—	—	2	7	20	28	39	23	6	2	—	127	15.4	1.4	0.12
St. Andrews Bay	—	—	—	—	—	—	2	1	1	—	1	—	5	14.6	1.7	0.75
Apalachicola	—	—	—	7	12	64	101	93	45	7	—	—	329	15.7	1.2	0.07
Flint	—	—	—	—	5	4	14	22	5	4	—	—	54	15.4	1.3	0.22
Ochlockonee	—	—	—	1	—	3	10	22	9	—	—	—	45	15.2	1.0	0.15
Apalachee Bay	—	—	—	—	2	12	30	16	4	2	—	—	66	15.8	1.0	0.12
Suwannee River	—	—	—	1	2	5	23	29	18	6	1	—	85	15.1	1.2	0.13
Suwannee Springs	—	—	1	—	3	11	13	2	1	—	—	—	31	16.6	1.1	0.20
St. Johns	—	—	1	4	19	32	20	7	4	—	—	—	87	16.8	1.2	0.13
Ogeechee	—	—	—	—	1	2	5	6	2	—	—	—	16	15.0	1.1	0.27
Edisto	—	—	—	—	—	3	9	12	2	1	—	—	27	15.4	0.9	0.18
nigrofasciata x *raneyi*																
Altamaha	—	—	3	9	13	6	11	3	—	—	—	—	45	17.5	1.5	0.22
Mid-Savannah	—	—	3	6	15	26	11	11	1	—	—	—	73	17.0	1.3	0.16
Combahee	—	—	—	1	4	7	9	4	1	—	—	—	26	16.6	1.2	0.23
raneyi																
Upper Savannah	4	7	25	35	13	10	2	1	1	—	—	—	98	19.0	1.4	0.14

TABLE 5.

FREQUENCY DISTRIBUTIONS OF THE LEAST NUMBER OF SCALES AROUND THE CAUDAL PEDUNCLE OF SEVERAL POPULATIONS OF *Percina nigrofasciata* BY DRAINAGE SYSTEMS

	27	26	25	24	23	22	21	20	19	18	17	16	N	$\bar{x}$	SD	SE
nigrofasciata																
Mississippi	—	—	—	—	—	—	—	—	—	1	—	—	1			
L. Pontchartrain	—	—	1	2	12	16	21	1	1	—	—	—	54	21.9	1.1	0.15
Pearl & Wolf	—	—	1	3	26	30	80	41	14	1	—	—	196	21.1	1.2	0.09
Pascagoula	—	—	—	1	5	15	40	18	5	—	—	—	84	21.0	1.0	0.11
Mobile Bay	—	—	1	3	6	4	20	31	12	5	—	1	83	20.5	1.5	0.17
Black Warrior	—	—	1	12	18	17	10	6	2	—	—	—	66	22.3	1.4	0.17
Coosa	—	—	—	6	18	17	6	5	1	1	—	—	54	22.1	1.3	0.18
Perdido	—	—	—	—	—	—	1	15	4	5	2	—	27	19.3	1.1	0.21
Conecuh-Escambia	—	—	1	—	10	11	13	7	4	1	—	—	47	21.4	1.4	0.21
Blackwater	—	—	—	—	—	3	9	24	25	7	4	—	72	19.5	1.1	0.13
Yellow	—	—	—	1	1	5	21	9	4	1	—	—	42	20.8	1.1	0.17
Choctawhatchee	—	—	—	4	13	28	35	23	22	2	—	—	127	20.9	1.4	0.13
St. Andrews Bay	—	—	—	—	—	—	—	1	3	1	—	—	5	19.0	0.7	0.32
Apalachicola	—	—	—	3	23	53	128	84	28	5	1	—	325	20.8	1.1	0.06
Flint	—	—	—	1	2	4	25	13	8	2	—	—	55	20.6	1.2	0.16
Ochlockonee	—	—	—	—	—	3	8	22	11	1	—	—	45	20.0	0.9	0.13
Apalachee Bay	—	—	—	—	—	5	25	18	17	—	1	—	66	20.2	1.0	0.12
Suwannee River	—	—	—	—	—	6	18	24	29	7	1	—	85	19.8	1.1	0.12
Suwannee Springs	—	—	—	—	3	7	17	2	2	—	—	—	31	21.2	1.0	0.17
Ogeechee	—	—	—	—	—	1	11	5	—	—	—	—	23	20.8	0.5	0.10
Edisto	—	—	—	—	—	4	12	5	5	—	—	—	26	20.6	1.0	0.19
nigrofasciata x *raneyi*																
Altamaha	—	2	3	8	15	10	5	2	—	—	—	—	45	22.9	1.4	0.21
Mid-Savannah	—	—	2	8	31	19	9	4	1	—	—	—	74	22.5	1.2	0.14
Combahee	—	—	—	—	16	3	5	—	1	—	—	—	25	22.3	1.1	0.21
raneyi																
Upper Savannah	1	—	7	24	35	13	16	3	—	—	—	—	99	22.9	1.3	0.13

percina. Means and ranges of scale counts appear in Tables 1-5.

The spinous dorsal fin is usually barely separated from the soft dorsal fin. In some specimens a wider division is found. The longest spine of the dorsal fin is usually the fourth, most of the remaining spines closely approximating each other in length. Exceptions are the first and last two spines which are shorter. The soft dorsal fin is higher than the spinous. The fourth ray is usually the longest, with the first, and the last three, the shortest. The remaining ones are nearly equal. The pelvic fins are angulate on the inner and outer margins with a pointed tendency at mid-fin. The first pelvic ray is often much thicker than the others, and the tips of the first three rays are thickened at the ends. The caudal fin is slightly emarginate and consists of seventeen rays, fifteen of which are branched. The anal fin is long. Its first spine is slightly shorter than the second, and is often thickened. The longest soft ray is usually the fourth. The remaining rays, with the exception of the first three, and the last, which are shorter, are nearly all of the same length. Means and ranges of fin counts appear in Tables 6-8.

The preopercle is usually entire, but sometimes is serrulate. The horizontal arm is longer than the vertical arm. The upper jaw extends just slightly posterior to the anterior margin of the eye. The mouth is moderate, slightly sub-terminal and somewhat oblique. Branchiostegal rays number six. Gill rakers number nine plus two. The maxillary frenum is broad and wide.

The lateral canal of the head contains five pores. The three posterior-most are equally spaced along a nearly straight line, and are located at the ends of posteriorly directed narrow tubes. The fourth most posterior is located slightly obliquely and inferiorly to the above three pores. The fifth most posterior is found approximately half way between the fourth most posterior pore and the posterior margin of the eye. The supratemporal canal is complete and consists of a median and two lateral pores. The median pore is found at the end of a narrow posteriorly projecting tube, and the two lateral pores are found at the end of tubes which project ventrad and posteriorward. The infraorbital canal contains eight pores. The first is located below and behind the anterior nostril. The second and third open from tubes which are directed downward to a point near the maxillary groove. The fourth is located dorsad and posteriorly from the latter two, and under the anterior portion of the eye. The last four open from long slender tubes. The first two of which project downwards and backward, while the last two project upward and backward. Ten preoperculomandibular pores are present. Six large ones are located on the preopercle and open from short, rather wide tubes. The remainder are located on the ventral contour of the head. The most posterior stands more or less alone, while the final three are nearly equally spaced. Two interorbital pores are present and may be out of line rather than arranged along a longitudinal plane. A single postorbital pore is present and opens

from a short posteriorly directed tube. The anterior nasal pore lies in a line with the superior portion of the tubular anterior nostril. The posterior nasal pore is oblique, anterior to the posterior nostril slit, and opens from a very short backward projecting tube. The coronal pore opens from a rather narrow long tube on the anterior portion of the occiput. The tube may appear sinuous. Terminology for head pores is after Hubbs and Cannon (1935: 10).

Coloration.—Color varies widely in specimens throughout the range. However, certain color patterns are found to be rather stable. In life, the color of the dorsum varies from light to dark olivaceous. Below, the color is lighter than the shade above. A greenish-gold sheen, which is not retained in alcohol specimens, is present on the cheek and opercle. There are as many as sixteen lateral vertical bars present. These are, as a rule, in the form of ellipses, and alternate with shorter and more ovate markings. The bars are imposed on a darkened lateral stripe which straddles the pores of the lateral line. The first elliptical vertical bar is found posterior to the insertion of the pectoral fin and the remaining ones extend to the caudal fin. Often, the bars anterior to the vent extend to a greater total vertical distance, but bars posterior to the vent may completely band the specimen in the region of the caudal peduncle. Dorsad, the bars do not cross the mid-line or conjoin with bars of the opposite side. From the anterior insertion of the second dorsal fin posteriorly, the bars often become less elliptical and become more confluent. In the Apalachicola Bay and St. Andrews Bay drainages the vertical bars scarcely extend below the lateral line, and are consistently found in the form of squarish blotches in some individuals, rather than ellipses. In females, pigmentation is often present in the form of spots and blotches below the lateral line and between the ventrad extensions of the lateral bars.

Viewed from above, seven dark blotches are present, (there may be as few as six or as many as eight) and these straddle the mid-line, terminating just superior to the furthest dorsal extension of the lateral bars. These are sometimes difficult to see in darkly colored individuals. The first blotch is located just posterior to the nape and the last is found just anterior to the caudal fin. A subocular bar may, or may not, be present. A dark band extends upward from the anterior corner of the eye, through the anterior nostril and usually conjoins the band from the opposite side of the head. This junction most often occurs on the upper lip, in the region of the maxillary symphysis. The dark band also continues backward from the posterior margin of the eye to the lateral stripe immediately posterior to the opercle. In its posterior extension, the dark band is also directly inferior to a dash of yellow pigment, which in turn, is just inferior to the lateral edge of the occiput.

The dorsal spines and rays may be clear, or pigmented with alternating dark bands. Adult males more often possess non-banded clear

TABLE 6.
FREQUENCY DISTRIBUTIONS OF THE NUMBER OF RAYS IN THE FIRST DORSAL FIN OF SEVERAL POPULATIONS OF *Percina nigrofasciata* BY DRAINAGE SYSTEMS

	15	14	13	12	11	10	9	N	$\bar{x}$	SD	SE
nigrofasciata											
Mississippi	—	—	—	—	—	1	—	1			
L. Pontchartrain	—	—	13	42	3	1	—	59	12.1	0.6	0.07
Pearl & Wolf	—	1	52	128	15	—	1	197	12.2	0.6	0.04
Pascagoula	—	1	11	63	8	1	—	84	12.0	0.6	0.06
Mobile Bay	—	—	11	52	17	2	—	82	11.9	0.7	0.07
Black Warrior	—	—	5	50	12	—	—	67	11.9	0.5	0.06
Coosa	—	—	4	31	15	—	—	50	11.8	0.6	0.08
Perdido Bay	—	—	7	17	4	1	—	29	12.0	0.7	0.14
Conecuh-Escambia	—	—	5	35	7	—	—	47	12.0	0.5	0.07
Blackwater	—	—	11	50	11	—	—	72	12.0	0.6	0.07
Yellow	—	—	5	33	4	—	—	42	12.0	0.5	0.07
Choctawhatchee	—	—	17	84	26	—	—	127	11.9	0.6	0.05
St. Andrews Bay	—	—	—	3	2	—	—	5	11.6	0.5	0.25
Apalachicola	1	5	66	224	39	2	—	337	12.1	0.6	0.03
Flint	—	—	14	36	5	—	—	55	12.2	0.6	0.08
Ochlockonee	—	—	5	32	6	2	—	45	11.9	0.6	0.10
Apalachee Bay	—	—	32	32	2	—	—	66	12.5	0.6	0.07
Suwannee River	—	—	14	61	9	—	—	84	12.1	0.5	0.06
Suwannee Springs	—	—	7	21	3	—	—	31	12.1	0.6	0.10
St. Johns	—	1	26	54	6	—	—	87	12.3	0.6	0.06
Ogeechee	—	—	2	20	1	—	—	23	12.0	0.4	0.08
Edisto	—	—	1	21	5	—	—	27	11.8	0.5	0.09
nigrofasciata x *raneyi*											
Altamaha	—	—	9	29	7	—	—	45	12.0	0.6	0.09
Mid-Savannah	—	1	27	40	7	—	—	75	12.3	0.6	0.07
Combahee	—	—	8	17	1	—	—	26	12.3	0.5	0.10
raneyi											
Upper Savannah	—	—	5	71	22	1	—	99	11.8	0.5	0.05

TABLE 7.

FREQUENCY DISTRIBUTIONS OF THE NUMBER OF RAYS IN THE SECOND DORSAL FIN OF SEVERAL POPULATIONS OF *Percina nigrofasciata* BY DRAINAGE SYSTEMS

	13	12	11	10	9	8	N	$\bar{x}$	SD	SE
nigrofasciata										
Mississippi	1	—	—	—	—	—	1			
L. Pontchartrain	—	20	37	1	—	—	58	11.3	0.5	0.07
Pearl & Wolf	4	80	107	6	—	—	197	11.4	0.6	0.04
Pascagoula	2	22	57	3	—	—	84	11.3	0.6	0.06
Mobile Bay	1	39	41	2	—	—	83	11.5	0.6	0.06
Black Warrior	—	41	25	1	—	—	67	11.6	0.5	0.06
Coosa	2	26	20	3	—	—	51	11.5	0.7	0.09
Perdido Bay	2	14	13	—	—	—	29	11.6	0.6	0.12
Conecuh-Escambia	5	35	7	—	—	—	47	12.0	0.5	0.07
Blackwater	1	34	35	2	—	—	72	11.5	0.6	0.07
Yellow	1	21	19	1	—	—	42	11.5	0.6	0.09
Choctawhatchee	8	80	38	1	—	—	127	11.8	0.6	0.05
St. Andrews Bay	—	1	4	—	—	—	5	11.2	0.4	0.20
Apalachicola	4	82	192	36	—	—	314	11.2	0.6	0.04
Flint	—	23	31	—	—	1	55	11.4	0.6	0.08
Ochlockonee	—	15	28	1	—	—	44	11.3	0.5	0.08
Apalachee Bay	—	5	37	24	—	—	66	11.7	0.6	0.07
Suwannee River	10	52	23	—	—	—	85	11.9	0.6	0.07
Suwannee Springs	1	18	11	1	—	—	31	11.6	0.6	0.11
St. Johns	2	16	60	9	—	—	87	11.1	0.6	0.06
Ogeechee	—	12	11	—	—	—	23	11.5	0.5	0.11
Edisto	1	16	10	—	—	—	27	11.7	0.6	0.11
nigrofasciata x *raneyi*										
Altamaha	—	13	27	5	—	—	45	11.2	0.6	0.09
Mid-Savannah	—	14	44	17	—	—	75	11.0	0.6	0.07
Combahee	3	22	1	—	—	—	26	12.1	0.4	0.08
raneyi										
Upper Savannah	—	17	68	14	—	—	99	11.0	0.6	0.06

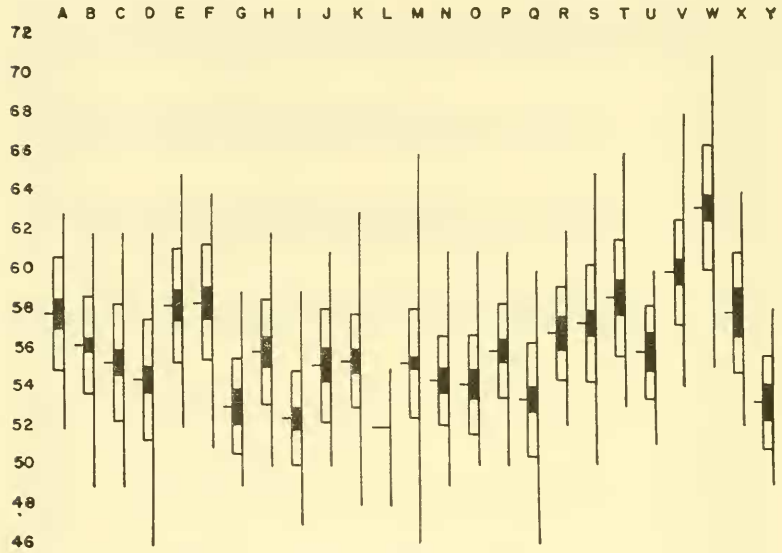


Figure 1. Comparison of the Number of Scales in the Lateral Line of *Percina nigrofasciata* by Drainage Systems. The following letters apply to the respective drainage systems. Lake Pontchartrain (A), Pearl and Wolf (B), Pascagoula (C), Mobile Bay (D), Black Warrior (E), Coosa (F), Perdido Bay (G), Conecuh-Escambia (H), Blackwater (I), Yellow (J), Choctawhatchee (K), St. Andrews Bay (L), Apalachicola Bay (M), Flint (N), Ochlockonee (O), Apalachee Bay (P), Suwannee River (Q), Suwannee Springs (R), St. Johns (S), Altamaha (T), Ogeechee (U), Mid-Savannah (V), Upper Savannah (W), Combahee (X), Edisto (Y).

rays. The soft dorsal fin often appears to have a light longitudinal stripe throughout its length. This is an expression of two large and well developed dark bands which enclose a large area of no pigmentation. The dorsal fin membranes may be clear, darkened and opaque, or peppered with dark pigment spots. The latter condition is the most common. Intense pigmentation, if present, is confined near the fin base. In a few adult males, a black border is present around the margin of the spinous dorsal fin.

The pectoral rays are usually peppered with pigment, but the connecting membranes are more often clear. The pelvic rays and membranes are both usually sprinkled with pigment. The anal fin rays and membranes follow those of the pelvics most closely in pigmentation.

The caudal fin is usually marked with two to five vertical bars but may be devoid of them. These are formed by alternating rings of dark pigment confined to the rays. In large males the fin may appear opaque. The membranes between the rays are spotted with pigment as a rule, but may be clear.

At the base of the hypural plate, two or three sometimes indiscrete dark spots are usually found. One occurs in the middle with one on each side at the dorsal and ventral margins of the plate, respectively. Often, two of the three spots conjoin and form a lunar marking.

Sexual dimorphism.—Males are larger and darker colored than females. The vertical lateral bars of males tend to be more discrete and are, as a rule, less confluent. There are present, enlarged ctenoid scales on the mid-ventral line of males. The mid-ventral line of females is either naked or covered with ctenoid scales not different in appearance from those on the body. Scutellation on the subtriangular muscle mass between the pelvic fins is more pronounced in males. The genital papillae are short, rounded and indiscretely villiform in males, while in females they are long, conical and clearly villiform. The spaces between the ventrad extensions of the lateral vertical bars below the lateral line are nearly always without spots and blotches in males. Females, on the other hand, are often spotted and blotched in these spaces, and this pigmentation extends to the venter. Banding of the fin rays is more common in females. Males more often have fin rays which appear clear or opaque. Very little difference occurs in proportional measurements (Table 10).

Comparisons.—Of the species of *Percina, P. sciera* seems to be the closest relative. In the Pearl River and Lake Pontchartrain drainages, these two forms occur together and identification is difficult. Both may have serrulate preopercles, the condition being more common in

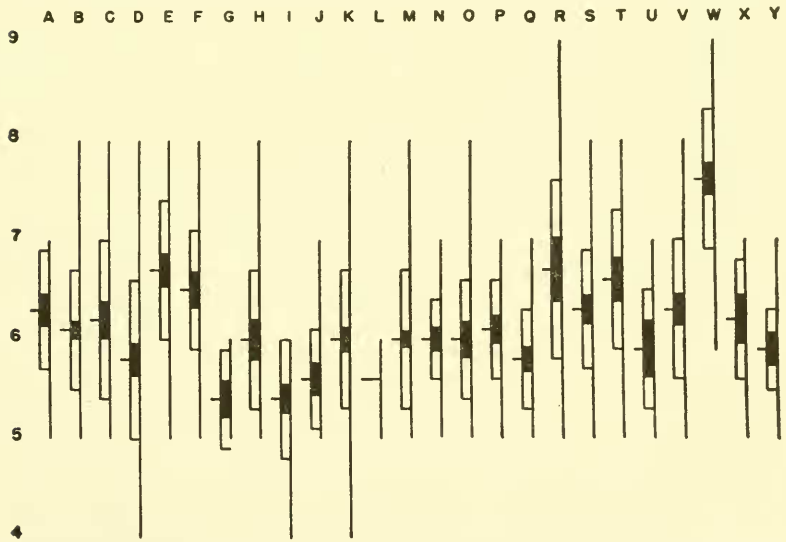


Figure 2. Comparison of the Number of Scales Above the Lateral Line of *Percina nigrofasciata* by Drainage Systems. Arrangement as in fig. 1.

TABLE 8.

FREQUENCY DISTRIBUTIONS OF THE NUMBER OF RAYS IN THE PECTORAL FINS OF SEVERAL POPULATIONS OF *Percina nigrofasciata* BY DRAINAGE SYSTEMS

	32	31	30	29	28	27	26	25	24	23	N	$\bar{x}$	SD	SE
nigrofasciata														
Mississippi	—	—	—	—	—	1	—	—	—	—	1			
L. Pontchartrain	—	—	—	2	44	4	7	—	—	—	57	27.7	0.7	0.10
Pearl & Wolf	—	—	14	10	140	19	11	—	—	—	194	28.0	0.8	0.06
Pascagoula	—	1	5	2	60	7	7	—	1	—	83	27.9	1.0	0.11
Mobile Bay	—	—	14	10	48	1	6	1	—	—	80	28.3	1.1	0.12
Black Warrior	—	—	6	4	50	4	2	—	—	—	66	28.1	0.8	0.10
Coosa	—	—	5	2	33	7	7	—	—	—	54	27.8	1.0	0.14
Perdido Bay	—	—	5	1	21	1	—	1	—	—	29	28.2	1.0	0.19
Conecuh-Escambia	—	1	12	8	22	2	2	—	—	—	47	28.6	1.1	0.16
Blackwater	—	1	29	8	33	—	1	—	—	—	72	28.9	1.0	0.12
Yellow	1	—	19	6	13	—	1	1	—	—	41	29.1	1.3	0.20
Choctawhatchee	—	2	55	15	53	2	—	—	—	—	127	29.0	1.0	0.09
St. Andrews Bay	—	—	1	—	4	—	—	—	—	—	5	28.4	0.9	0.40
Apalachicola	2	4	69	20	169	19	29	—	—	—	312	28.3	1.2	0.07
Flint	—	—	5	6	29	6	9	—	—	—	55	27.9	1.1	0.15
Ochlockonee	—	—	8	4	30	2	1	—	—	—	45	28.4	0.9	0.14
Apalachee Bay	—	—	4	5	45	9	2	—	—	—	65	28.0	0.8	0.09
Suwannee River	—	—	9	12	53	5	5	—	—	—	84	28.2	0.9	0.10
Suwannee Springs	—	—	11	1	17	1	—	—	—	—	30	28.7	1.0	0.19
St. Johns	—	—	1	2	23	18	52	3	3	1	103	26.6	1.1	0.11
Ogeechee	—	—	4	4	13	1	—	—	—	—	22	28.5	0.9	0.18
Edisto	1	—	13	4	8	1	—	—	—	—	27	29.2	1.1	0.22
nigrofasciata x *raneyi*														
Altamaha	—	—	6	—	29	—	9	—	—	—	44	27.9	1.2	0.18
Mid-Savannah	—	—	6	2	57	3	5	—	1	—	74	28.0	0.9	0.11
Combahee	—	—	2	6	13	4	1	—	—	—	26	28.2	0.9	0.18
raneyi														
Upper Savannah	—	—	4	7	66	8	14	—	—	—	99	27.8	0.9	0.09

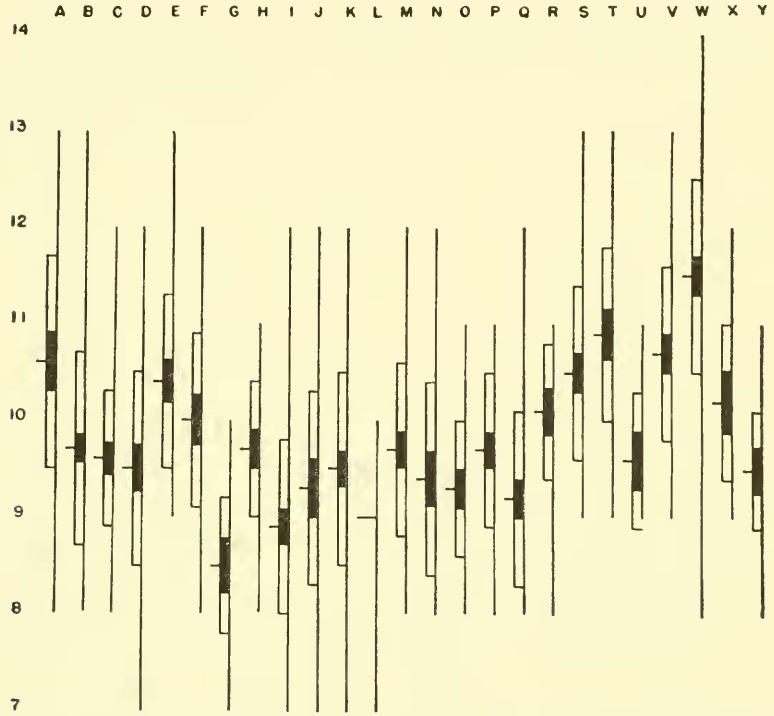


Figure 3. Comparison of the Number of Scales Below the Lateral Line of *Percina nigrofasciata* by Drainage Systems. Arrangement as in fig. 1.

P. sciera. The number of scales in the lateral line shows considerable overlap, as does the number of dorsal fin rays. However, these meristic characters may be helpful in recognizing differences between series. When these species are taken together, color pattern seems to be the one most valuable criterion in separating the two forms. In *P. nigrofasciata* the lateral vertical bars are more elliptical and extend further ventrad than those of *P. sciera* which are broadly ovate in shape and scarcely extend below the lateral stripe. A comparison between *P. nigrofasciata* and *P. sciera* in the number of scales in the lateral line and the number of spines in the first dorsal fin appears in Table 15. These specimens were taken together in two collections, from the Lake Pontchartrain drainage, by Reeve M. Bailey.

Specimens of *P. nigrofasciata* differ from specimens of *P. maculata* in the absence of scales on the nape of the latter species. Dorsal fin and lateral-line scale counts are lower in *P. nigrofasciata* than in *P. maculata.* In addition, one very prominent and distinct dark spot at the base of the caudal fin is present in *P. maculata,* differing from the three more diffuse spots of *P. nigrofasciata.*

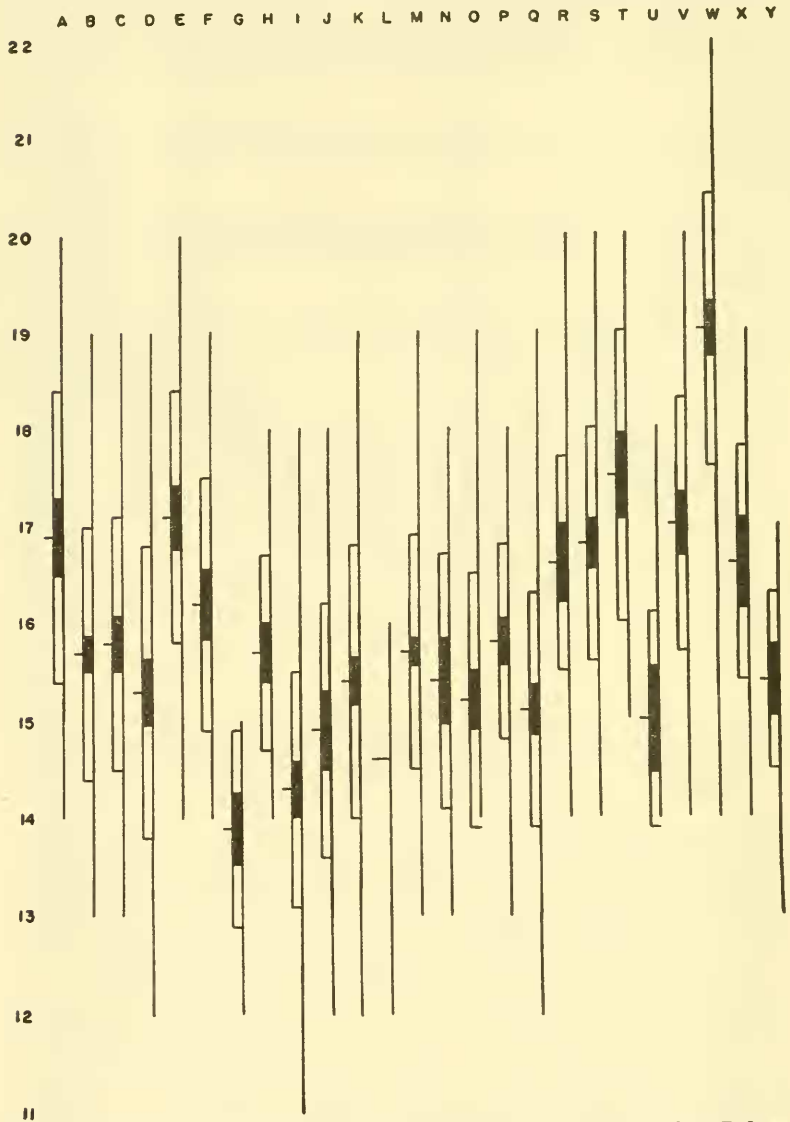


Figure 4. Comparison of the Number of Scales Above Plus Below the Lateral Line of *Percina nigrofasciata* by Drainage Systems. Arrangement as in fig. 1.

P. nigrofasciata differs markedly from *P. palmaris* in color pattern. The paired eye-like spots at the base of the caudal fin, and the white border around the spinous dorsal fin of *P. palmaris* serve to separate the two forms.

P. nigrofasciata contrasts with *P. uranidea* most obviously in the presence of seven blotches on the dorsal mid-line as opposed to four blotches for *P. uranidea.* In addition, the first dorsal fin count is higher in *P. nigrofasciata.*

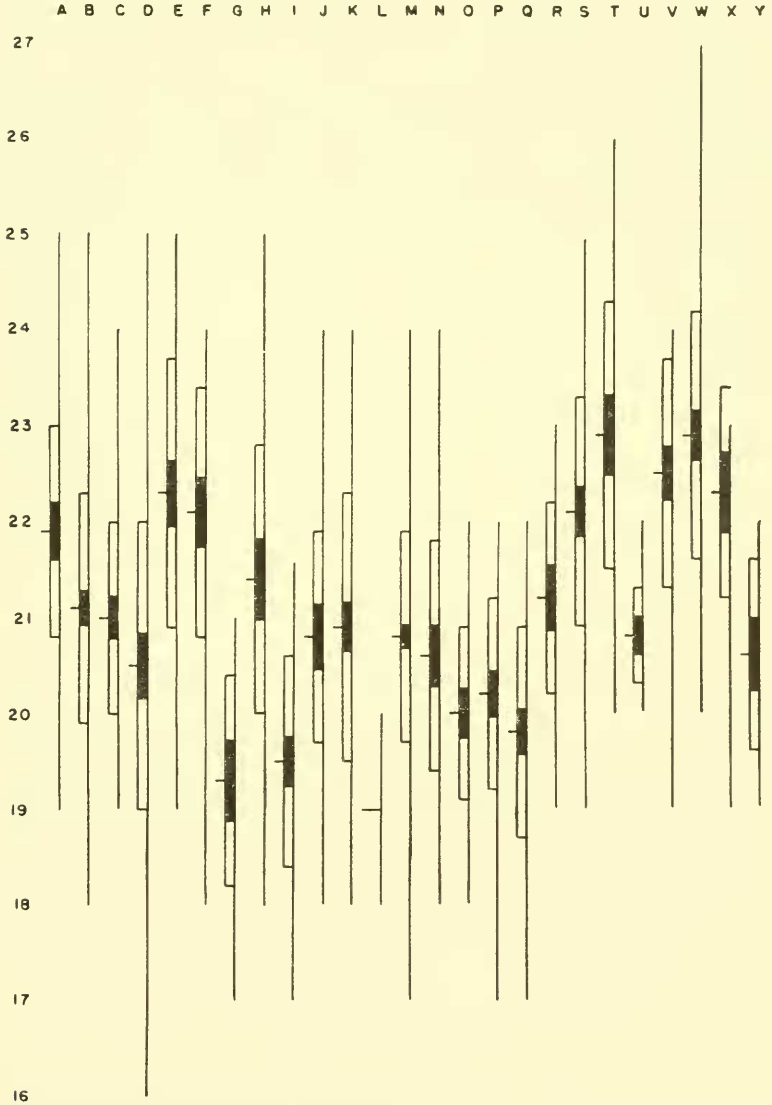


Figure 5. Comparison of the Number of Scales Around the Caudal Peduncle of *Percina nigrofasciata* by Drainage Systems. Arrangement as in fig. 1.

It differs from *P. copelandi* in many ways. Among these are the shape of the head, higher dorsal fin count and higher lateral-line scale count for *P. nigrofasciata.* The lateral markings on *P. copelandi* are reduced to short, oblong blotches rather than elliptically shaped ones for *P. nigrofasciata.*

The above comparisons apply to species of *Percina* found within the range of *P. nigrofasciata.*

Origin and dispersal.—Probably *Percina nigrofasciata* was derived from ancestral stock which closely resembled *P. sciera.* From knowledge of the range of *P. sciera* its origin was very likely at a locality west of the Mississippi River. Possibly a population segment of the *sciera* like ancestor gradually made its way down the Mississippi River drainage, and in the region southeast of the river, was cut off from the main population. This could have occurred by flooding of the river basin or by a westward drainage shift. The consequence in either case being isolation of the segment from its parent stock. Several instances of flooding by the Mississippi River are discussed by Gunter (1952: 122).

Differentiation, through mutation during isolation, of the restricted form into *P. nigrofasciata* presumably occurred. Opportunity was present for the new form to disperse eastward through the rivers and

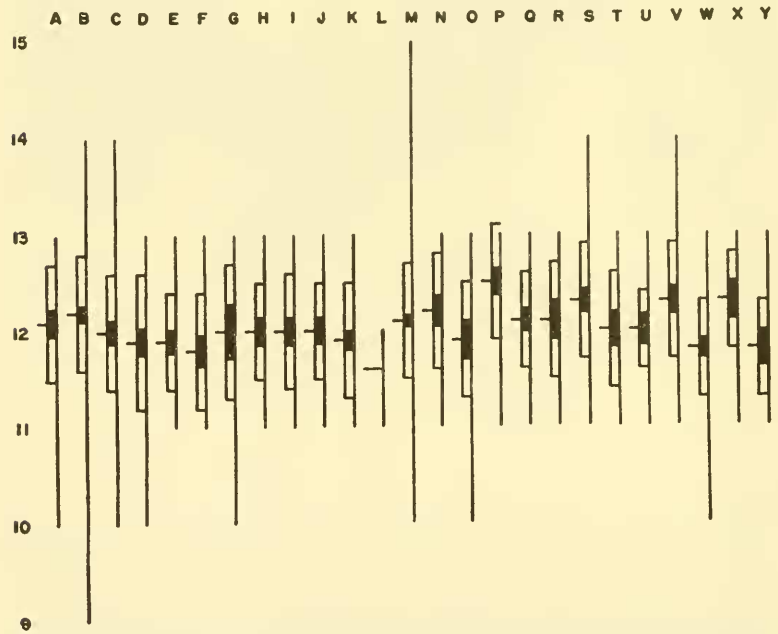


Figure 6. Comparison of the Number of Rays in the First Dorsal Fin of *Percina nigrofasciata* by Drainage Systems. Arrangement as in fig. 1.

connecting swamps of the Gulf Coastal Plain. Dispersal was perhaps further facilitated by the nearly complete absence of other species of *Percina* throughout the coastal plain. Pressure for available habitats of the new population was likely at a maximum, and the spread may have been rapid. Dispersal southward into peninsular Florida via the St. Johns and Suwannee River system was perhaps expedited again by the absence of closely related forms. Northward ascent into the piedmont region and mountains of South Carolina and Georgia may have been gradual or could have been forced during one of the submergences of the coastal plain during the Pleistocene (Carr 1940: 6; Hobbs 1942: 34, map 3). Whatever the case, the basic adaptability of this species to a variety of habitats has been shown.

It is entirely plausible to assume that even today much interchange of waters from drainage to drainage due to lowland flooding occurs along the Gulf Coastal Plain. For this reason further isolation for

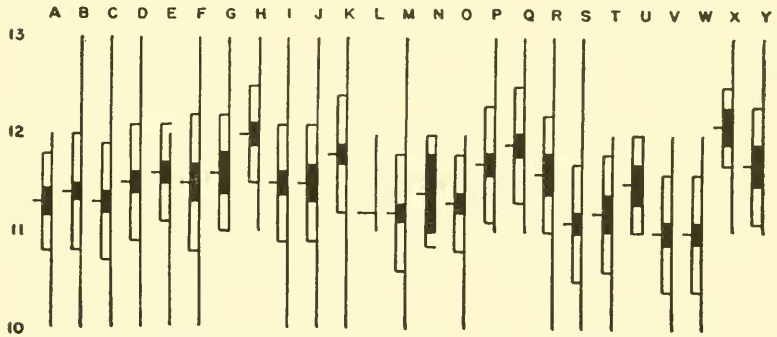


Figure 7. Comparison of the Number of Rays in the Second Dorsal Fin of *Percina nigrofasciata* by Drainage Systems. Arrangement as in fig. 1.

P. n. nigrofasciata has been limited and differentiation has been incomplete, due to gene flow between populations in adjacent rivers throughout the coastal plain. The only differentiation to be noted today is incipient, and *P. n. nigrofasciata* is relatively stable throughout the Gulf drainages. Some racial differentiation has occurred, but it is restricted to populations of *P. n. nigrofasciata* in drainages which are in themselves somewhat ecologically distinct. These are located in the extreme lowlands and mountains. One of the river systems, the Suwannee, contains springs which afford a different microhabitat.

P. nigrofasciata and *P. sciera* have been taken together in the Pearl and Lake Pontchartrain drainages of Louisiana and Mississippi. However, no evidence of intergradation has been noted, and the respective forms seem to be relatively unsuccessful in invading each others range. Perhaps this is further evidence for the closeness of relationship between the two forms.

Differentiation of *P. nigrofasciata* into *P. n. raneyi* above the fall line in the Savannah River system corresponds to a pattern well known in freshwater fishes. The lowland species making its way above the fall line with differentiation subsequently taking place has been noted previously with *Notropis cummingsae* and *Notropis altipinnis* (Hubbs and Raney 1948: 6, 1951: 4).

Two different interpretations are suggested for the dispersal and eventual differentiation of *P. nigrofasciata* above the fall line in the Savannah River system. The first favors a gradual movement up the river, with preadapted forms able to transcend the barrier. The

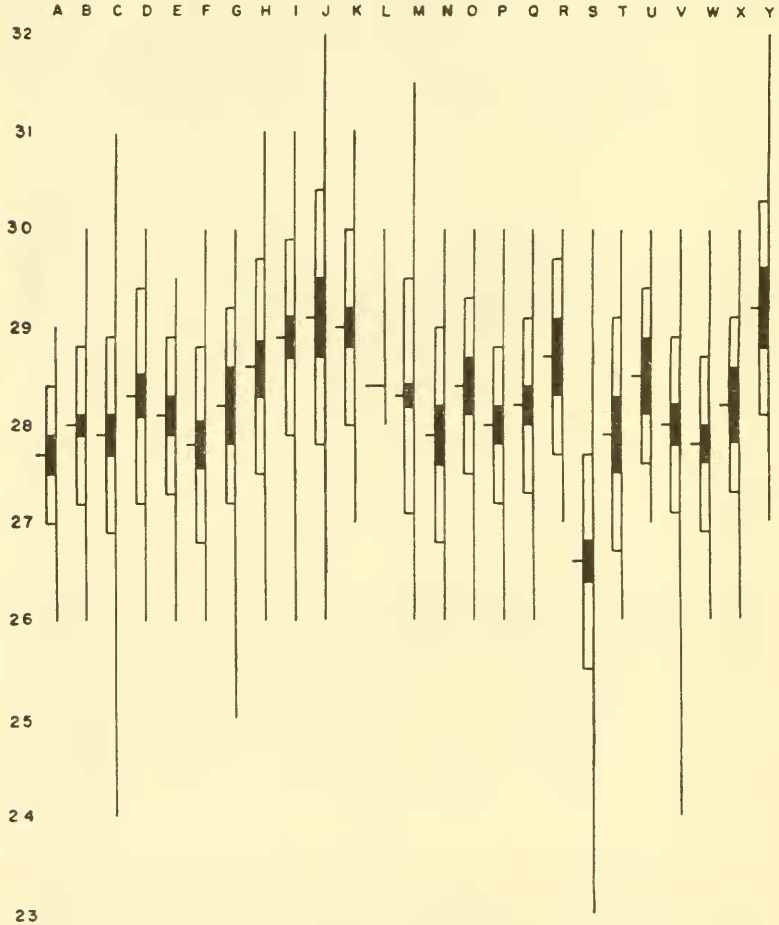


Figure 8. Comparison of the Number of Rays in the Pectoral Fins of *Percina nigrofasciata* by Drainage Systems. Arrangement as in fig. 1.

TABLE 9.
PROPORTIONAL MEASUREMENTS OF *Percina nigrofasciata* THROUGHOUT ITS RANGE

No. specimens	*nigrofasciata* 208 Mean (Range)	intergrades 30 Mean (Range)	*raneyi* Holotype Mean	*raneyi* 25 Paratypes Mean (Range)
In standard length				
body depth	5.3 (4.4-6.5)	5.3 (4.8-6.0)	4.7	5.4 (4.6-5.9)
head length	3.8 (3.5-4.1)	3.8 (3.6-4.0)	3.9	3.8 (3.6-4.1)
In head length				
head width	2.0 (1.6-2.4)	1.9 (1.7-2.1)	1.8	1.9 (1.7-2.2)
head depth	2.1 (1.9-2.5)	2.1 (1.8-2.4)	2.1	2.2 (2.1-2.3)
eye length	4.3 (3.5-5.4)	4.1 (3.6-4.8)	4.5	4.3 (3.7-4.7)
snout length	4.4 (3.7-5.0)	4.3 (3.7-5.1)	4.7	4.7 (4.3-5.1)
upper jaw length	3.8 (3.1-4.6)	3.7 (3.4-4.0)	3.9	3.9 (3.6-4.4)
depth caudal peduncle	3.3 (2.6-3.9)	3.2 (2.8-3.7)	2.7	2.9 (2.7-3.3)
longest first dorsal	2.3 (1.8-2.9)	2.1 (1.9-2.4)	2.7	2.6 (2.2-2.9)
longest second dorsal	1.9 (1.6-2.5)	1.9 (1.8-2.1)	2.1	2.0 (1.8-2.3)
longest pectoral	1.2 (1.1-1.5)	1.2 (1.2-1.3)	1.6	1.3 (1.1-1.6)
longest pelvic	1.4 (1.2-1.6)	1.4 (1.3-1.6)	1.6	1.5 (1.5-1.8)
longest caudal	1.5 (1.3-2.0)	1.5 (1.3-1.6)	1.5	1.6 (1.5-1.8)
longest anal	1.7 (1.5-2.1)	1.8 (1.5-2.0)	2.3	2.2 (1.7-2.6)
In eye length				
least fleshy interorbital width	1.3 (0.9-1.7)	1.3 (1.1-1.6)	1.3	1.4 (1.3-1.8)
least bony interorbital width	1.8 (1.1-2.7)	2.0 (1.7-2.5)	2.0	2.0 (1.5-2.8)
In distance from insertion of most anterior pelvic ray to union of gill membranes				
mandible tip to gill membranes union	1.1 (0.9-1.5)	1.1 (0.9-1.3)	1.2	1.1 (0.9-1.3)
pelvic girdle insertion to gill membranes union	2.1 (1.6-2.8)	2.2 (1.9-2.6)	2.3	2.2 (2.0-2.4)

second holds for stream capture.

If the population gradually made its way over the fall line as the first hypothesis postulates it would be hard to explain the derivation of *P. n. raneyi* in the upper Savannah River system only as *P. nigrofasciata* makes its way over the fall line in other river systems. Populations commonly occur above the fall line in the Apalachicola and Alabama River systems for example. If gradual ascent was the answer in the upper Savannah River one would expect that the only differences from *P. nigrofasciata* would be on a gradual or clinal basis much as they are in the other river systems. In these systems there is very little difference between extreme lowland populations and populations far above the fall line in meristic characters.

The second postulation, that of stream capture, seems to explain the differentiation of *P. n. raneyi* much more logically. Probably the immediate ancestors of this form made their way into the upper Savannah River through stream capture a long time before the gradual ascension of the lower Savannah population. It has been pointed out that the Tugaloo River, a tributary of the Savannah, in times past has captured a tributary of the Chattahoochee River, the Chestatee (Hayes and Campbell 1894: 63-126, 1900: 131-33; Campbell 1896: 677-78; and Johnson 1907: 211-48). This capture presumably antedated the ascension of all of the Atlantic drainage populations, but the Gulf drainages were probably populated at this time from mouth to headwaters. As a result of the capture the upper Savannah population was isolated from the basic stock in a new habitat, and differentiation presumably occurred at a rather rapid rate. Further evidence for the Chattahoochee population being the direct ancestral stock from which *P. n. raneyi* evolved is seen in several normally stable proportional measurements. Proportions of body depth into standard length, head length into standard length, and highest dorsal fin into head length show very close affinity between the two populations (Tables 9, 12).

PERCINA NIGROFASCIATA NIGROFASCIATA (Agassiz)

(Tables 1-14, figures 1-9, map. 1)

Hadropterus nigrofasciatus, Agassiz, 1854: 305 (original description, type locality, Mobile, Alabama). Jordan, 1876: 310 (description, Etowah and Oostanaula Rivers, synonymy), 1877: 14 (range in part, South Carolina to Louisiana). Jordan and Brayton, 1878: 40-45 (Chattahoochee River near Gainesville, abundant in Alabama). Jordan, 1878: 438 (range). Jordan and Gilbert, 1883: 249 (South Carolina). Jordan, 1885: 79 (range, compiled). Jordan and Evermann, 1896a: 1038 (description, range, synonymy: 1896b: 359 (range). Evermann and Kendall, 1900: 72 (Escambia, synonymy). Jordan, 1905: 312 (Georgia rivers). Radcliffe and Welsh, 1912: 31 (range, compiled). Palmer and Wright, 1920: 357 (range, after Jordan 1876, and Jordan and Brayton, 1878). Pratt, 1923: 126

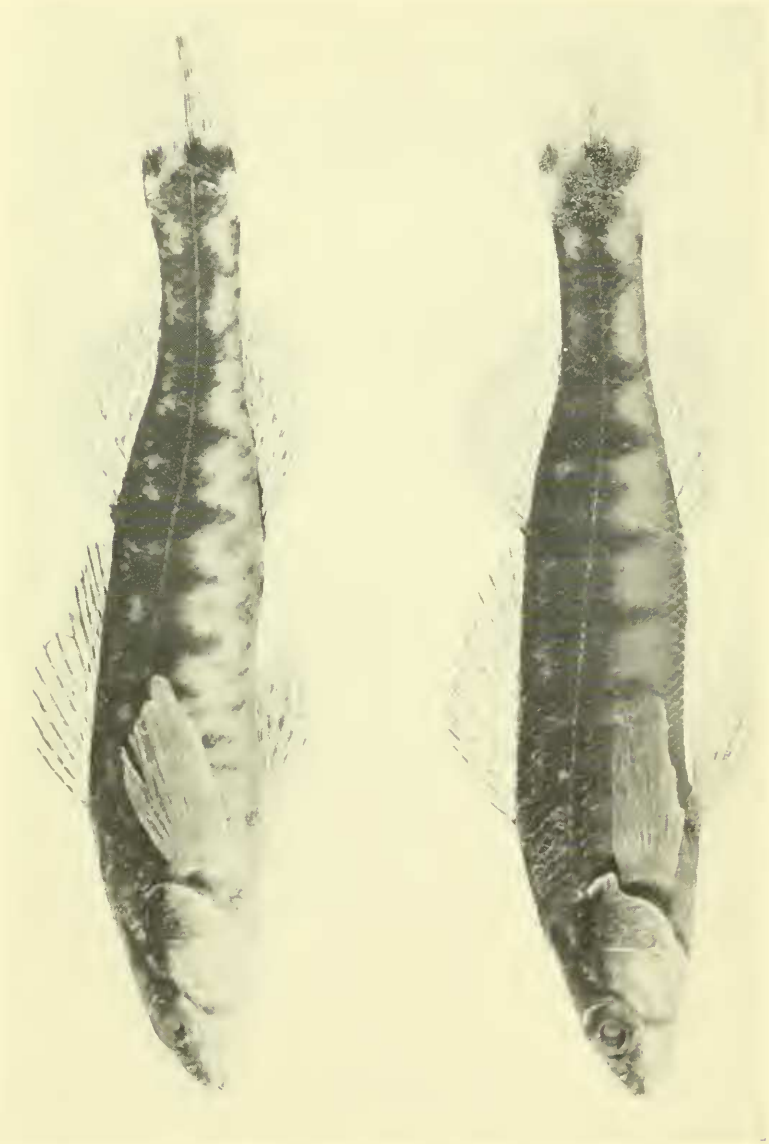


Figure 9. *Percina nigrofasciata nigrofasciata*
Above: Female, 58.0 mm., CU 16657, Semmes Co., Ala., Mobile Bay Drainage.
Below: Male, 58.0 mm., CU 16657, Semmes Co., Ala., Mobile Bay Drainage. (Photographs by Douglass M. Payne)

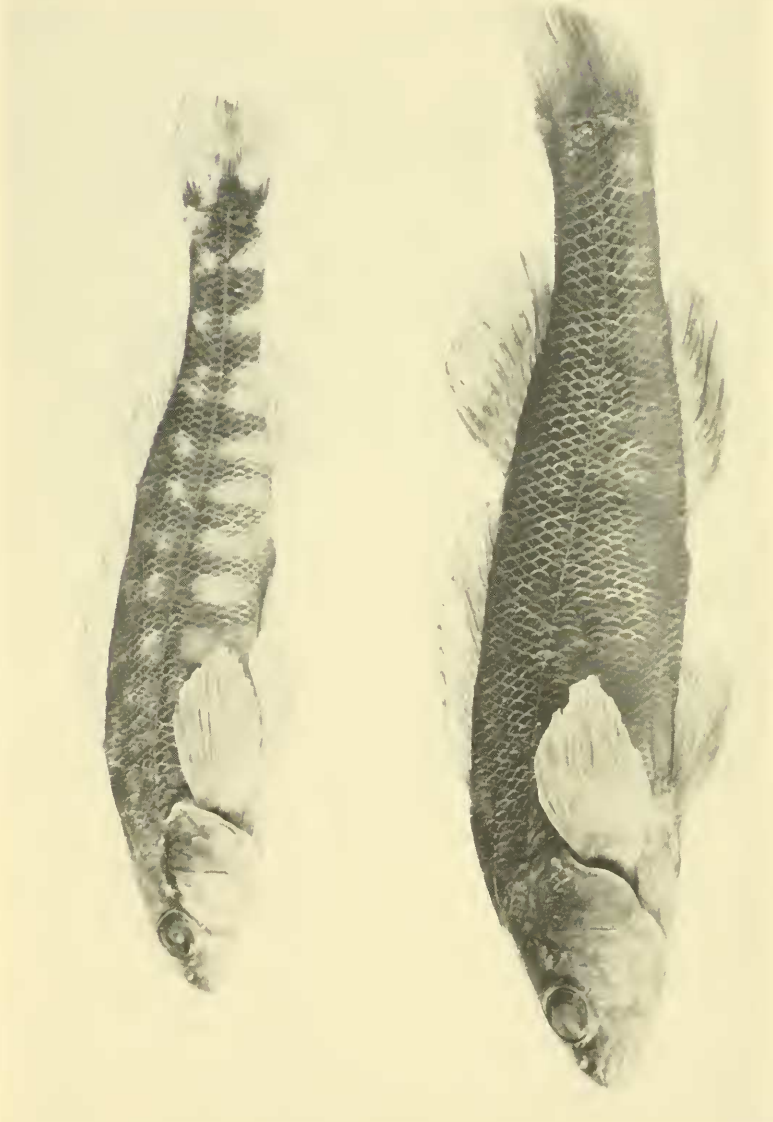


Figure 10. *Percina nigrofasciata raneyi*
Above: Female, 65.0 mm., CU 23344, Abbeville Co., So. Carolina, Upper Savannah River Drainage. (Paratype)
Below: Male, 79.3 mm., CU 23344, Abbeville Co., So. Carolina, Upper Savannah River Drainage. (Holotype) (Photographs by Douglass M. Payne)

TABLE 10.

PROPORTIONAL MEASUREMENTS BY SEXES OF *Percina nigrofasciata*

	nigrofasciata		*raneyi*	
	50 Male Mean (Range)	50 Female Mean (Range)	10 Male Mean (Range)	10 Female Mean (Range)
In standard length				
body depth	5.4 (4.6-6.1)	5.4 (4.5-6.5)	5.2 (4.7-5.8)	5.1 (4.7-5.9)
head length	3.6 (3.4-4.1)	3.8 (3.4-4.0)	3.8 (3.6-4.0)	3.8 (3.6-4.1)
In head length				
head width	2.0 (1.7-2.3)	2.0 (1.7-2.4)	1.9 (1.8-2.0)	1.9 (1.7-2.2)
head depth	2.1 (1.9-2.4)	2.2 (1.8-2.4)	2.2 (2.1-2.2)	2.2 (2.1-2.3)
eye length	4.3 (3.7-4.9)	4.2 (3.6-4.6)	4.4 (4.0-4.8)	4.2 (3.7-4.7)
snout length	4.4 (3.7-4.9)	4.4 (3.7-5.0)	4.7 (4.3-5.1)	4.8 (4.5-5.1)
upper jaw length	3.8 (3.1-4.3)	3.8 (3.3-4.6)	3.8 (3.6-4.1)	3.9 (3.7-4.3)
depth caudal peduncle	3.2 (2.8-3.9)	3.3 (2.8-3.9)	2.9 (2.7-3.0)	3.0 (2.8-3.3)
longest first dorsal	2.3 (2.0-2.7)	2.4 (2.0-2.7)	3.8 (3.6-4.0)	3.8 (3.6-4.1)
longest second dorsal	1.8 (1.6-2.1)	1.9 (1.6-2.5)	2.0 (1.8-2.1)	2.1 (1.9-2.2)
longest pectoral	1.3 (1.1-1.5)	1.2 (1.1-1.4)	1.4 (1.2-1.6)	1.3 (1.1-1.5)
longest pelvic	1.4 (1.2-1.6)	1.4 (1.2-1.6)	1.5 (1.3-1.6)	1.5 (1.3-1.7)
longest caudal	1.5 (1.3-1.7)	1.5 (1.3-2.0)	1.6 (1.5-1.8)	1.7 (1.5-1.8)
longest anal	1.7 (1.5-2.0)	1.7 (1.5-2.1)	2.1 (1.7-2.5)	2.2 (1.7-2.6)
In eye length				
least fleshy interorbital width	1.3 (1.1-1.7)	1.3 (1.1-1.6)	1.3 (1.2-1.4)	1.5 (1.3-1.8)
least bony interorbital width	1.8 (1.5-2.5)	1.9 (1.5-2.4)	2.0 (1.8-2.1)	2.1 (1.5-2.8)
In distance from insertion of most anterior pelvic ray to union of gill membranes				
mandible tip to gill membranes union	1.1 (0.9-1.3)	1.1 (0.9-1.3)	1.1 (1.0-1.3)	1.1 (1.0-1.3)
pelvic girdle insertion to gill membranes union	2.1 (1.9-2.6)	2.1 (1.8-2.8)	2.3 (2.2-2.4)	2.2 (2.0-2.4)

TABLE 11.

FREQUENCY DISTRIBUTIONS OF SEVERAL PROPORTIONAL MEASUREMENTS OF *Percina nigrofasciata* FROM ATLANTIC COAST DRAINAGE SYSTEMS

	Length of Snout into Head Length (in mm.)																	Longest First Dorsal into Head Length												
	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	N	Mean	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	N	Mean
nigrofasciata																														
St. Johns	—	—	—	1	2	2	1	2	4	2	1	—	—	—	—	15	4.4	—	—	—	1	3	1	2	1	1	—	—	9	2.4
Ogeechee	—	—	—	—	—	—	—	—	—	3	2	—	—	—	—	5	4.2	—	—	1	—	1	2	—	—	1	—	—	5	2.4
Edisto	—	—	—	—	—	—	2	2	2	2	1	1	—	—	—	10	4.4	—	—	—	1	—	—	2	1	1	—	—	5	2.3
intergrades																														
Altamaha	1	—	—	1	—	1	1	3	1	—	1	1	—	—	—	10	4.5	—	—	—	—	—	3	—	—	1	1	—	5	2.3
Mid-Savannah	—	—	—	—	—	—	1	2	1	1	—	1	2	1	1	10	4.1	—	—	—	—	—	1	—	2	1	1	—	5	2.2
Combahee	—	—	1	1	—	—	2	1	3	2	—	—	—	—	—	10	4.4	—	—	—	—	—	—	—	—	2	1	2	5	2.0
raneyi																														
Upper Savannah	1	1	4	4	6	3[1]	2	2	2	—	—	—	—	—	—	25	4.7	2	3	5	4	5[3]	2	2	2	—	—	—	25	2.6

	Depth of Caudal Peduncle into Head Length														Longest Anal into Head Length													
	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	N	Mean	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	N	Mean
nigrofasciata																													
St. Johns	—	—	—	—	1	—	3	3	—	—	4	2	2	15	3.0	—	—	—	—	—	—	1	—	6	4	4	—	15	1.7
Ogeechee	1	1	—	2	—	—	1	—	—	—	—	—	—	5	3.6	—	—	—	—	—	—	—	—	—	4	—	—	4	1.7
Edisto	—	—	—	1	1	3	4	—	—	—	1	—	—	10	3.3	—	—	—	—	—	—	1	2	3	4	—	—	10	1.8
intergrades																													
Altamaha	—	—	—	—	1	—	1	1	2	1	4	—	—	10	3.1	—	—	—	—	—	—	—	1	4	4	1	—	10	1.8
Mid-Savannah	—	—	—	—	1	—	5	1	2	—	—	1	—	10	3.2	—	—	—	—	—	—	3	3	2	2	—	—	10	1.9
Combahee	—	—	1	1	—	1	2	2	3	—	—	—	—	10	3.3	—	—	—	—	—	—	—	—	2	4	3	1	10	1.7
raneyi																													
Upper Savannah	—	—	—	—	—	—	1	3	—	3[2]	11	6	1	25	2.9	1	2	1	5	6	2[4]	2	3	1	2	—	—	25	2.2

[1] Average divergence: 82.0%. Line of separation between 4.5 and 4.6.
[2] Average divergence: 79.5%. Line of separation between 3.0 and 3.1.
[3] Average divergence: 77.7%. Line of separation between 2.4 and 2.5.
[4] Average divergence: 84.0%. Line of separation between 2.0 and 2.1.

(compiled). Jordan, Evermann and Clark, 1930: 283 (range, synonymy). Fowler, 1935: 22 (synonymy, coloration, Orangeburg, South Carolina). Pratt 1935: 119 (compiled). Carr, 1937: 84 (characters, Key, Florida). Viosca, 1937: 136 (Gulf drainages). Schrenkeisen, 1938: 214 (compiled). Bailey, 1940: 525-30 (comparison). Driver, 1942: 287 (compiled). Hubbs and Allen, 1943: 125 (Silver Springs, Florida). Driver, 1950: 297 (compiled). Crawford, 1953: 235 (characters).

Etheostoma nigrofasciatum, Vaillant, 1873: 69 (description, range, synonymy). Jordan, 1876: 223 (confused in description, range). Jordan and Copeland, 1876: 164 (range). Bollman, 1887: 464 (Escambia River). Gilbert, 1888: 229 (Ogeechee River); 1891: 155, 159 (Alabama Basin, Escambia River). Boulenger, 1895: 80 (range, description, synonymy). Palmer and Wright, 1920: 357 (range).

Plesioperca anceps, Vaillant, 1873: 37 (plate, description, synonymy).

Hadropterus spillmani, Hay, 1880: 491 (description, Chickasawha at Enterprise, synonymy); 1882: 60, 74 (Tombigbee and Chickasawha Rivers).

Hadropterus nigrofasciatus westfalli, (misidentification)—Fowler, 1942: 9 (Wekiwa River, Florida, in error, actually was Wekiva River, Florida; plate, description, synonymy); 1945: 293 (Orlando-Titusville road, coloration in part).

Hadropterus nigrofasciatus nigrofasciatus, Fowler, 1945: 354 (description, Alabama).

Percina nigrofasciata, Bailey, Winn and Smith, 1954: 141 (Escambia River, revision). Bailey and Gosline, 1955: 12, 36 (comparison, Wilkinson Co., Mississippi).

The nominal subspecies, *Percina n. westfalli,* is not considered as a subspecies herein. Henry W. Fowler described this form on the basis of one specimen and by comparison with specimens of *P. n. nigrofasciata* from Alabama only (1942: 9-11). He distinguished *P. n. westfalli* by the size of the eye: 3.25 in head; compared to 4.2 (3.5-5.4) as found by the author in specimens of *P. n. nigrofasciata* (Table 14). From critical examination of specimens from the type locality and other collections of the St. Johns River system, no appreciable or significant difference was found between eye lengths of the form called *westfalli* and specimens of *nigrofasciata.* The only character in which the St. Johns fishes showed any appreciable difference was in the number of pectoral rays. The amount of difference shown was not considered adequate to recognize this fish as a subspecies (Table 8).

Range.—Mississippi River system, Louisiana to Edisto River system, Georgia. Southward into peninsular Florida throughout the Suwannee and St. Johns River systems.

Diagnosis.—Scale counts lower than those of *P. n. raneyi:* lateral line, 46 to 66 (usually 50 to 60); above the lateral line, 4 to 9

TABLE 12.

Frequency Distributions of Several Proportional Measurements of Four Races of *P. n. nigrofasciata* in the Gulf Drainages

Races	Body Length into Standard Length (in mm.)																					Head Length into Standard Length (in mm.)									
	6.5	6.4	6.3	6.2	6.1	6.0	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	No.	Mean	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	No.	Mean
Western	—	—	—	—	—	—	—	—	1	—	1	—	2	2	2	—	2	—	—	—	—	10	5.20	1	1	1	1	3	3	—	—	10	3.80
Upper Alabama	—	—	—	—	1	—	—	2	3	4	1	3	2	2	1	—	1	1	—	—	—	20	5.50	2	6	8	3	1	—	—	—	20	3.95
Coastal	1	—	—	—	1	3	—	2	4	2	1	—	—	1	—	—	—	—	—	—	—	15	5.85	—	1	—	5	8	—	1	—	15	3.75
Apalachicola Bay	—	—	—	—	—	—	—	—	—	—	1	—	2	4	5	7	3	2	1	1	1	20	5.00	—	2	6	10	5	5	2	—	30	3.75
Remaining Drainages	—	—	—	—	—	1	4	1	8	5	9	13	21	16	8	8	4	2	1	1	—	103	5.30	1	13	20	34	20	8	5	2	103	3.80

	Caudal Peduncle Depth into Head Length															Head Width into Head Length										
	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.6	No.	Mean	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	No.	Mean
Western	—	—	—	—	—	2	2	2	2	1	1	—	—	—	10	3.20	—	—	—	3	5	1	1	—	—	10	2.00
Upper Alabama	—	—	—	—	—	1	1	3	3	5	5	1	—	1	20	3.05	—	1	1	1	8	6	3	—	—	20	1.95
Coastal	2	1	2	4	2	2	—	1	1	—	—	—	—	—	15	3.55	—	1	1	6	1	1	—	—	—	10	2.10
Apalachicola Bay	1	—	—	1	4	1	3	5	3	6	2	3	—	—	30	3.25	—	—	1	—	1	9	5	8	1	25	1.85
Remaining Drainages	3	1	2	6	8	12	19	13	15	20	3	1	—	—	98	3.30	1	1	7	23	25	20	10	1	—	87	2.00

	Longest First Dorsal into Head Length													Head Depth into Head Length									
	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	No.	Mean	2.5	2.4	2.3	2.2	2.1	2.0	1.9	No.	Mean
Western	—	—	—	1	2	3	1	2	—	1	—	—	10	2.40	—	1	1	4	3	1	—	10	2.20
Upper Alabama	—	1	—	1	2	3	4	7	2	—	—	—	20	2.35	—	2	3	5	7	2	1	10	2.15
Coastal	—	—	—	—	—	3	2	2	2	1	—	—	10	2.30	1	1	7	6	—	—	—	15	2.25
Apalachicola Bay	2	2	4	6	4	6	1	—	—	—	—	—	25	2.60	—	—	1	9	9	6	5	30	2.05
Remaining Drainages	—	1	—	2	12	10	25	23	12	5	2	1	95	2.30	—	5	13	29	39	14	3	103	2.10

	Least Bony Interorbital Width into Eye Length															Longest Second Dorsal into Head Length										
	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	No.	Mean	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	No.	Mean
Western	—	—	—	—	—	—	—	1	—	4	2	2	1	—	—	10	1.70	—	—	—	—	—	—	2	5	2	1	10	1.80
Upper Alabama	—	—	—	—	—	—	—	—	3	4	7	4	2	—	—	20	1.70	—	—	—	—	2	2	5	2	5	2	18	1.85
Coastal	—	—	—	—	—	—	1	1	5	4	3	—	1	—	—	15	1.80	—	—	—	—	—	—	1	5	2	2	10	1.75
Apalachicola Bay	—	—	—	—	1	—	3	2	6	2	3	1	—	—	—	30	1.95	1	—	1	3	1	8	3	6	2	—	25	2.00
Remaining Drainages	1	—	1	1	1	2	4	7	12	22	21	15	10	—	1	98	1.80	—	—	1	1	2	10	28	25	18	2	87	1.90

(usually 5 to 7); below the lateral line, 7 to 13 (usually 9 to 11); above plus below the lateral line, 11 to 20 (usually 14 to 18); around the caudal peduncle, 16 to 25 (usually 19 to 23). Depth enters the standard length 5.3 times. The following proportional measurements enter the length of head: depth of caudal peduncle, 3.3; longest dorsal spine, 2.3; longest anal ray, 1.7; length of snout, 4.4. The values for proportional measurements indicate the means (Table 9).

Racial Analysis.—Eight races of *P. n. nigrofasciata* are recognized herein. These are, according to the drainage in which they are found: Western race, Lake Pontchartrain; Upper Alabama race, Coosa and Black Warrior; Apalachicola Bay race; Chattahoochee and Flint; Coastal race, Perdido Bay and Blackwater; Suwannee River race, Suwannee; Suwannee springs race, Suwannee; St. Johns River race, St. Johns; Eastern race, Ogeechee and Edisto.

The author assumes a genetic basis for the races. Of course, this is hard to directly show in several of the cases. However, there is good evidence to surmise that the differences between the races and adjacent populations do have a genetic basis. The above named races are significantly different in meristic and proportional characters from other populations of *P. n. nigrofasciata* and are therefore pointed out. It should be noted that there is little consistency between low scale counts and low altitude and high scale counts and high altitude. Environment does not seem directly to influence meristic characters.

For purposes of analysis, the drainages which flow into the Gulf of Mexico were considered as one geographical unit, and the drainages which flow into the Atlantic Ocean were considered as another geographical unit. Comparisons of scale counts and proportional measurements were made with the given race against all other drainages of the geographical unit in which *P. n. nigrofasciata* occurs. It is felt that this procedure of comparison gives more reliable indications of divergence than a procedure in which the incipiently speciated units are compared against themselves only. Arithmetical separations which give figures for average divergences were made in accordance to Ginsburg (1938: 255-59). These divergences served as a tool to point out significant differences between populations to the author. Actual figures for average divergences are not included in the text but may be easily computed from the frequency distributions in Tables 12-14. Two exceptions to the above procedure of comparison are to be noted. When analysis of the Upper Alabama race was made, the Western race was not included with the remainder of the Gulf drainages. In the same manner, the Upper Alabama race was not included with the rest of the Gulf drainages when the Western race was analyzed. This alternative procedure was employed to prevent similarities, apparently due to convergence, from becoming masked. The second exception was in regard to comparison of the forms within the Suwannee drainage. Significant differences occur in all scale characters (Tables 1-5, 13) between specimens in the Suwannee River and its tributaries as compared to specimens which

TABLE 13.

FREQUENCY DISTRIBUTIONS OF SEVERAL PROPORTIONAL MEASUREMENTS OF TWO RACES OF *P. n. nigrofasciata* IN THE SUWANNEE RIVER AND SPRINGS

	Upper Jaw Length into Head Length (in mm.)										
	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	No.	Mean
River Race	—	—	—	—	2	—	3	3	3	10	3.8
Springs Race	1	1	—	3	2	1	—	2	—	10	4.0

	Caudal Peduncle Depth into Head Length						
	3.5	3.4	3.3	3.2	3.1	3.0	No.	Mean
River Race	—	—	2	3	1	4	10	3.1
Springs Race	3	1	1	1	2	2	10	3.0

	Longest First Dorsal into Head Length										
	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	No.	Mean
River Race	—	—	—	—	1	2	3	2	1	1	10	2.2
Springs Race	1	—	1	1	2	4	—	1	—	—	10	2.4

	Longest Second Dorsal into Head Length							
	2.2	2.1	2.0	1.9	1.8	1.7	No.	Mean
River Race	—	—	—	3	4	3	10	1.8
Springs Race	1	—	1	6	1	1	10	1.9

	Longest Pelvic into Head Length						
	1.6	1.5	1.4	1.3	1.2	No.	Mean
River Race	—	—	4	5	1	10	1.3
Springs Race	1	4	3	2	—	10	1.4

	Longest Caudal into Head Length						
	1.6	1.5	1.4			No.	Mean
River Race	—	2	8			10	1.4
Springs Race	8	2	—			10	1.6

	Least Bony Interorbital Width into Eye Length													
	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	No.	Mean
River Race	—	—	—	—	—	—	1	3	1	2	2	1	10	1.9
Springs Race	1	—	1	1	1	2	1	—	2	1	—	—	10	2.2

TABLE 14.

FREQUENCY DISTRIBUTIONS OF SEVERAL PROPORTIONAL MEASUREMENTS OF TWO RACES OF *P. n. nigrofasciata* IN THE ATLANTIC DRAINAGES

Races	Body Depth into Standard Length (in mm.)													No.	Mean
	6.0	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8		
St. Johns	—	—	1	1	—	—	1	4	2	—	5	—	1	15	5.2
Eastern	—	1	—	1	3	—	2	3	1	1	—	1	1	14	5.4
	Head Length into Standard Length														
			4.0		3.9		3.8		3.7		3.6		3.5		
St. Johns			4		4		6		1		—		—	15	3.9
Eastern			—		—		2		1		8		4	15	3.6
	Eye Width into Head Length														
	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	No.	Mean
St. Johns	—	—	—	—	—	1	3	1	4	2	1	—	3	15	4.2
Eastern	1	—	1	1	3	1	3	1	3	1	—	—	—	15	4.4
	Caudal Peduncle Depth into Head Length														
	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.0	2.9	2.8	2.7	No.	Mean
St. Johns	—	—	—	—	1	—	3	3	—	—	4	2	2	15	3.0
Eastern	1	1	—	3	1	3	5	—	—	—	1	—	—	15	3.4
	Least Bony Interorbital Width into Eye Length														
		2.1	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1		No.	Mean
St. Johns		1	—	2	5	4	1	2	—	—	—	—		15	1.8
Eastern		—	3	3	1	—	5	—	2	—	—	1		15	1.7

inhabit springs in the Suwannee drainage. Consequently, the fishes of the Suwannee drainage could not be logically regarded as a single unit. As a result, spring specimens were compared against river specimens as two discrete populations. For analysis of the two races, comparisons were made only with specimens from the Suwannee drainage, as two definite ecological niches are present. It could be that this is an example of dual invasion into the Suwannee of two populations of closely related stock. If this is the case, the most recent population to enter had to resort to the microhabitat the older population was not inhabiting. Isolation, and swift differentiation may have ensued. It seems probable that it is the spring populations that are differentiating in relation to the much higher scale counts found. Certainly a very concrete isolating mechanism is available here in the presence of the two microhabitats. The very interesting situation here seems to afford an excellent opportunity for regional study in the future.

The Western race diverges in all scale characters (Tables 1-5). The number of body scales is high and is quite similar to those of specimens of the Upper Alabama race. This is a prime example of no correlation between high scale counts and high elevation, as the Lake Pontchartrain drainage is restricted to the lowlands. Even so, scale counts for this race are the highest of any of the populations in the Gulf drainage with the exception of the Black Warrior system (Tables 1-5).

The Upper Alabama race differentiates from the Gulf Coast forms by the presence of a greater number of body scales (Tables 1-5). The head is longer and the caudal peduncle is deeper in specimens of this race (Table 12). The race occurs in rivers which extend above the fall line, and while no definite isolating mechanism is known for the race, it is a well known fact that many species after making their way above the fall line have subsequently differentiated.

The Apalachicola Bay race contrasts in body depth and has a wider head (Table 12). Specimens of this race are robust. In addition, they differ in color pattern. Many male specimens are marked with block-shaped bars which extend ventrad only to the lateral stripe. Females are often profusely spotted. Members of this race are one more example of fishes which occur from the coastal plain to the mountains, far above the fall line, with no correlation between high number of scales and a low number of scales in relation to altitudinal gradient (Tables 1-5).

The number of body scales is consistently lower in specimens of the Coastal Race (Tables 1-5) than in other adjacent lowland coastal plain rivers. In body proportions the Coastal Race diverges from the remaining Gulf Coast forms in: depth of caudal peduncle, head depth, head width, and body depth (Table 12). Forms of this race, as a whole, appear elongate and less robust than do most populations of *P. n. nigrofasciata.* This could, of course, be a nutritional factor. Scale counts are uniformly lower for specimens of this race than

TABLE 15.

FREQUENCY DISTRIBUTIONS OF THE NUMBER OF SCALES IN THE LATERAL LINE AND THE NUMBER OF SPINES IN THE FIRST DORSAL FIN OF SPECIMENS OF *Percina nigrofasciata* AND *Percina sciera*

	Total Scales in the Lateral Line																
Species	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	No.	Mean
P. nigrofasciata	—	—	—	—	1	—	1	1	2	6	3	1	3	2	1	21	57.3
P. sciera	1	1	2	3	1	2	2	4	3	1	1	—	1	—	—	22	61.4

	Total Spines in the First Dorsal Fin				
Species	13	12	11	No.	Mean
P. nigrofasciata	3	15	4	22	12.0
P. sciera	7	8	—	15	12.5

they are for specimens from adjacent lowland drainages.

The Eastern and St. Johns River races of the Atlantic drainages separate from one another in all scale and fin counts (Tables 1-5). In body proportions they contrast in: body depth, head length, eye length, depth of caudal peduncle, and least bony interorbital width (Table 14). The St. Johns River specimens also differ in coloration. Males often have a black border around the dorsal margin of the spinous dorsal fin. The St. Johns River extends deep into peninsular Florida and the fishes of this system are in a recognized center of endemism. The Eastern race occurs in drainages nearly exclusively confined to the piedmont region. In comparing the two races, it should be noted that the St. Johns River race which is found at a much lower altitude has consistently higher scale counts than the Eastern race which occurs at much higher elevations.

PERCINA NIGROFASCIATA **RANEYI,** subsp. nov.

(Tables 1-11, 15, figures 1-8, 10, map 1)

Hadropterus nigrofasciatus, Jordan and Brayton, 1878: 30 (Toccoa Creek near Toccoa Falls, Georgia).

Holotype: An adult male (CU 23344), collected in a tributary to the Savannah River, 7.6 miles east of Calhoun Falls, Abbeville County, South Carolina, on Route 72, March 27, 1951 by Edward C. Raney, Ronald W. Crawford, Richard H. Backus, C. Richard Robins, James N. Layne and Roland L. Wigley.

Scale and fin counts for the holotype are: lateral line, 61; above lateral line, 8; below the lateral line, 12; above plus below lateral line 20; caudal peduncle, 22; first dorsal, 11; second dorsal, 11; total of pectorals, 29. Proportional measurements appear in Table 9.

Paratypes: 41 specimens which were taken with the holotype (CU 19599). Other specimens studied are listed under material examined.

The new form is named for Dr. Edward C. Raney of Cornell University whose investigations on darters and other freshwater fishes of the southeastern United States are well known.

Range.—Savannah River system, Georgia and South Carolina, above the fall line.

Diagnosis.—Scale counts higher than in subspecies *nigrofasciata:* lateral line, 55 to 71 (usually 60 to 66); above the lateral line, 6 to 9 (usually 7 to 8); below the lateral line, 8 to 14 (usually 9 to 13); above plus below the lateral line, 14 to 22 (usually 17 to 20); around the caudal peduncle, 20 to 27 (usually 21 to 24) (Tables 1-5). Depth enters the standard length 5.1 times. The following proportional measurements enter the length of head: depth of caudal peduncle, 2.9; longest dorsal spine, 2.6; longest anal ray, 2.2; length of snout, 4.7 (Table 9). The values given for proportional measurements indicate the means.

Comparison of P. n. nigrofasciata and P. n. raneyi.—The subspecies *raneyi* differs from *nigrofasciata* in: the number of scales in the

lateral line; above the lateral line; below the lateral line; above plus below the lateral line; and around the caudal peduncle. Average divergences for all scale characters, exclusive of the scales around the caudal peduncle, with the best lines of separation are summarized below, and may be applied to (Tables 1-4).

Scale Character	Average Divergence	Line of Separation
Lateral line	92.0%	59-60
Above lateral line	85.0%	6-7
Below lateral line	75.2%	11-12
Above plus below	86.2%	17-18

By the use of proportional measurements additional average differences may be shown by comparison of the following measurements. Length of head divided by: longest dorsal spine; longest anal spine; length of snout; and depth of caudal peduncle (Table 9).

Since intermediacy was not expressed by comparison of proportional measurements in the intergrades between the two subspecies, they are included with populations of *P. n. nigrofasciata* in comparison with *P. n. raneyi* (Table 9).

P. N. NIGROFASCIATA X P. N. RANEYI (Intergrades)

(Tables 1-9, 11, figures 1-8, map 1)

Hadropterus nigrofasciatus, Jordan and Brayton, 1878: 34 (flat shoals in the south fork of the Ocmulgee River). Freeman, 1953: 269 (Aiken and Barnwell counties, South Carolina).

Intermediate between subspecies *nigrofasciata* and *raneyi* in four scale counts: lateral line, 53 to 68 (usually 56 to 62); above the lateral line, 5 to 8 (usually 6 to 7); below the lateral line, 9 to 13 (usually 10 to 12); above the lateral line plus below the lateral line, 14 to 20 (usually 16 to 20) (Tables 1-5).

As proportional measurements do not consistently show intermediate tendencies, the intergrades were summed together with populations of *P. n. nigrofasciata* in the Atlantic drainages, when average divergences were computed in comparison with *P. n. raneyi* (Table 11).

Range.—Altamaha River system, Georgia; Savannah River system, Georgia and South Carolina, below the fall line; Combahee River system, South Carolina.

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Summary

Percina nigrofasciata is distributed widely in the southeastern United States. Its range is bounded to the west by the Mississippi River and to the east by the Edisto River, South Carolina. *P. nigrofasciata* extends southward into peninsular Florida by way of the Suwannee and St. Johns River systems. It extends northward as far as the headwaters of the Chattahoochee and Savannah River systems in Georgia and South Carolina.

Two subspecies of *P. nigrofasciata* are recognized herein. *P. n. nigrofasciata,* which has, in the past, usually been referred to as *Hadropterus nigrofasciatus,* and a new subspecies, *P. nigrofasciata raneyi. P. n. raneyi* has more body scales than does *P. n. nigrofasciata* and also differs in several body proportions.

The nominal subspecies *H. nigrofasciatus westfalli* is placed in synonymy. Populations of intergrades between the two subspecies are present in the Altamaha, Combahee and Savannah (below the fall line) River systems. Their intermediate tendencies are expressed mainly in the number of body scales.

Eight races of *P. n. nigrofasciata* are designated in this paper. Assignment of races was based on divergence of meristic characters and average body proportions from adjacent populations in immediate areas.

P. n. nigrofasciata apparently orignated on the coastal plain near the mouth of the Mississippi River from stock closely allied to *P. sciera,* which is the closest relative of *nigrofasciata* today. Dispersal of the new form proceeded eastward through connecting swampy areas during periods of high water. Dispersal northward may have been forced and rapid due to one of the submergences of the coastal plain during the Pleistocene, or it may have been gradual through the ascent of the populations up the streams.

P. n. raneyi originated above the fall line in the Savannah River system. Its immediate ancestors probably made their way over this barrier in one of two ways; by gradually ascending the barrier into waters above the falls, or through stream capture of the Chattahoochee River by the Savannah River, allowing fishes from the former system to enter the new habitat of the upper Savannah River. The author favors the latter explanation, as it explains the isolating mechanism necessary for differentiation to occur.

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P. n. nigrofasciata apparently originated on the coastal plain near the mouth of the Mississippi River. Dispersal proceeded eastward through connecting swampy areas during periods of high water. Dispersal northward may have been forced and rapid due to one of the submergences of the coastal plain during the Pleistocene, or it may have been gradual.

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